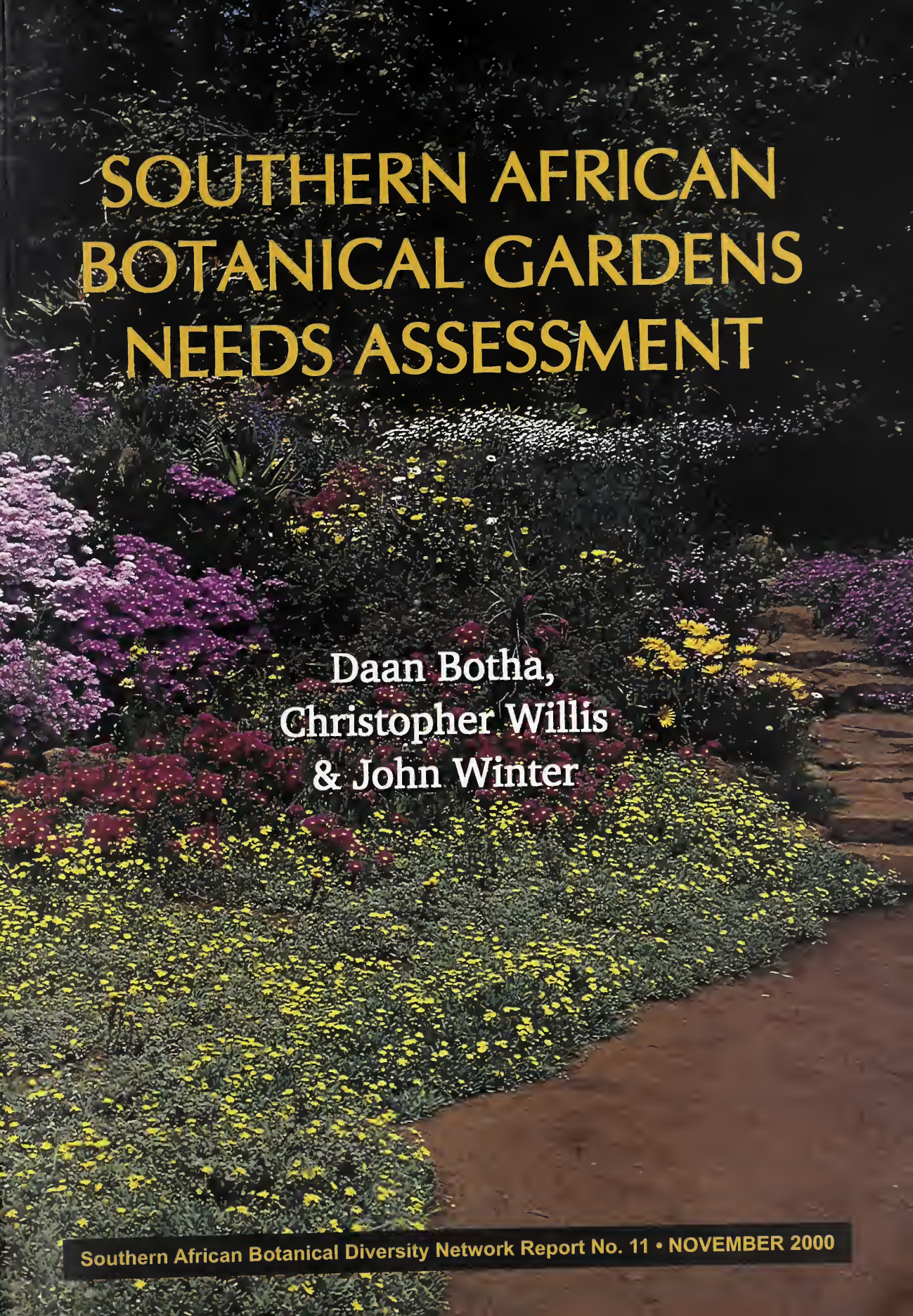

SOUTHERN AFRICAN BOTANICAL GARDENS NEEDS ASSESSMENT

Daan Botha,
Christopher Willis
& John Winter

Southern African Botanical Diversity Network Report No. 11 • NOVEMBER 2000

About SABONET

This publication is a product of the Southern African Botanical Diversity Network (SABONET), a programme aimed at strengthening the level of botanical expertise, expanding and improving herbarium and botanic garden collections, and fostering closer collaborative links among botanists in the southern African subcontinent.

The main objective of SABONET is to develop a strong core of professional botanists, taxonomists, horticulturists and plant diversity specialists within the ten countries of southern Africa (Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe). This core group will be competent to inventory, monitor, evaluate, and conserve the botanical diversity of the region in the face of specific development challenges, and to respond to the technical and scientific needs of the Convention on Biological Diversity.

To enhance the human resource capacity and infrastructure available in the region, SABONET offers training courses, workshops and collaborative expeditions in undercollected areas. The programme also produces a newsletter, *SABONET News*, and a series of occasional publications, the *Southern African Botanical Diversity Network Report Series*, of which this publication is part.

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IUCN
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USAID

GEF

United Nations Development Programme

TABLE OF CONTENTS

LIST OF FIGURES **5**
LIST OF TEXT BOXES **8**
ACKNOWLEDGEMENTS **9**
FOREWORD **10**
ABBREVIATIONS **11**
EXECUTIVE SUMMARY **12**
INTRODUCTION **13**
PART 1. SUMMARY OF NEEDS **15**
Scope **16**
Status **16**
Date of Foundation **16**
Mission **17**
Size of Garden **19**
Altitude and Rainfall **19**
Visitors **21**
Staff **21**
Nurseries and Greenhouses **24**
Seed Bank **25**
***In Vitro* Storage** **26**
Pollen Bank **27**
DNA Storage **27**
Research **27**
Environmental Education **29**
Herbaria and Libraries **29**
Infrastructural/Developmental Needs **30**
Botswana 30
Lesotho 30
Malawi 30
Mozambique 31
Namibia 32
South Africa 32
Zambia 36
Zimbabwe 36
Summary 37
Training needs **38**
Botswana 38
Lesotho 38
Malawi 38
Mozambique 39
Namibia 39
South Africa 39
Zambia 39
Zimbabwe 40
Recommendations **40**
Inventory/Garden Records 43
Funding 43
Collaboration 43
Conservation 43

Education/Training 44
Management 44
Marketing 44
Botanical Garden Management Course 45
Networking Southern African Botanical Gardens: The Way Forward 45
Integrating *Ex Situ* and *In Situ* Plant Conservation 47
Conclusion 52
PART 2. SOUTHERN AFRICAN BOTANICAL GARDENS 53
Botswana 54
National Botanical Garden (Gaborone) 54
Lesotho 57
Katse Botanical Garden (Katse Dam) 57
Malawi 61
Lilongwe National Botanic Garden (Lilongwe) 61
Mzuzu National Botanic Garden (Mzuzu) 64
Zomba National Botanic Garden (Zomba) 68
Mozambique 72
INIA Botanical Garden (Maputo) 72
Tunduru Botanical Garden (Maputo) 74
University Botanical Garden (Maputo) 77
Namibia 80
National Botanic Garden (Windhoek) 80
South Africa 84
Durban Botanic Gardens (Durban) 84
Free State National Botanical Garden (Bloemfontein) 87
Harold Porter National Botanical Garden (Betty's Bay) 91
Karoo Desert National Botanical Garden (Worcester) 97
Kirstenbosch National Botanical Garden (Cape Town) 101
Lowveld National Botanical Garden (Nelspruit) 105
Natal National Botanical Garden (Pietermaritzburg) 110
Pretoria National Botanical Garden (Pretoria) 114
Witwatersrand National Botanical Garden (Roodepoort/Krugersdorp) 118
Zambia 125
Munda Wanga Trust Botanical Garden (Chilanga) 125
Zimbabwe 129
National Botanic Garden (Harare) 129
REFERENCES & FURTHER READING 133
APPENDICES 144
Appendix 1. Questionnaire 144
Appendix 2. Southern African Botanic(al) Gardens: Contact Names and Addresses 146
Appendix 3: Summary Tables 149

LIST OF FIGURES

Figure 1. Number of gardens founded over the last 160 years. More than 50% of the gardens were founded between 1950 and 1980. 17
Figure 2. Garden size. Most gardens have both landscaped and natural areas. 20
Figure 3. Altitude. Southern Africa's gardens range from sea level to 2 150 m a.s.l. For gardens that have a wide range in altitude, the highest value was used in this chart. 20
Figure 4. Annual rainfall. Rainfall ranges from 250 mm to 3 000 mm, with most gardens receiving between 750 mm and 1 500 mm. 21
Figure 5. Number of vistors per annum. Visitor numbers are highly variable, ranging from 200 to 680 000 per year. South Africa's National Botanical Gardens receive an annual total of over one million visitors. 22
Figure 6. Number of paid garden staff, showing total garden staff, labour staff, and horticulturists. 22
Figure 7. Number of horticulturists relative to landscaped area and total garden area. Note the high value for Botswana's National Botanical Garden 23
Figure 8. Number of paid garden staff and labour staff relative to total garden area. Note the high values for Tunduru Botanical Garden. 24
Figure 9. Number of nurseries and greenhouses. The South African National Botanical Gardens are relatively well equipped. 25
Figure 10. Number of plant taxa. Some gardens could not specify the number of plant taxa. 28
Figure 11. Number of threatened plant taxa. Almost half the gardens do not have any threatened taxa. 28
Figure 12. The canal that passes through Botswana's National Botanical Garden and the building (middle) used to house the staff and natural history collections. (Photo: Christopher Willis) 55
Figure 13. A structure within Botswana's National Botanical Garden which is scheduled to be developed into a display house. (Photo: Christopher Willis) 55
Figure 14. The newly developed medicinal plant section of the Katse Botanical Garden, Lesotho. (Photo: Christopher Willis) 58
Figure 15. Recently developed terraces that follow the contours in the Katse Botanical Garden, Lesotho. (Photo: Christopher Willis) 58
Figure 16. View from the Katse Botanical Garden, Lesotho, overlooking the cold waters of the Katse Dam and the surrounding mountains. One of the newly developed paths of the garden can be seen in the foreground. (Photo: Christopher Willis) 59
Figure 17. Lesotho's national flower, the spiral aloe (*Aloe polyphylla*), grown in the Katse Botanical Garden, Lesotho. (Photo: Christopher Willis) 60
Figure 18. Part of Lilongwe National Botanic Garden is reserved for a demonstration orchard where mangoes, guavas, oranges, granadillas, peaches and apples are grown. (Photo: Augustine Chikuni) 62
Figure 19. Lilongwe National Botanic Garden. Most of the ornamentals are propagated in a screen house constructed with funds from DFID. (Photo: Augustine Chikuni) 63
Figure 20. Lilongwe National Botanic Garden. This landscaped area was dominated by *Acacia* before it was cleared in the 1970s to be replaced by *Gmelina arborea*. (Photo: Augustine Chikuni) 63
Figure 21. A part of Lilongwe National Botanic Garden dominated by *Combretum* species and *Piliostigma thonningii*. (Photo: Augustine Chikuni) 64
Figure 22. Mzuzu National Botanic Garden. Most of the garden is a botanical reserve dominated by *Brachystegia taxifolia, Uapaca nitida* and *Uapaca kirkiana*. The past ten years of intensive protection have resulted in regeneration of the vegetation. Initial funding for some activities was provided by the British High Commission. (Photo: Augustine Chikuni) 65
Figure 23. A small portion of Mzuzu National Botanic Garden has been landscaped. Landscaping is expected to continue once the master plan is on place. (Photo: Augustine Chikuni) 66
Figure 24. Communities are allowed to collect thatching grass from Mzuzu National Botanic Garden. This has improved community participation in the management of garden resources. (Photo: Augustine Chikuni) 67

Figure 25. Staff at Mzuzu National Botanic Garden collect and propagate seed of rare species in the nursery on a small scale. The seedlings are sold or donated to interested individuals. (Photo: Augustine Chikuni) 67
Figure 26. The Mulunguzi River runs through the Zomba National Botanic Garden, forming a habitat for a variety of aquatic plant species. (Photo: Augustine Chikuni) 68
Figure 27. Environmental education at Zomba National Botanic Garden. Instilling environmental awareness in the future leaders of Malawi. (Photo: Augustine Chikuni) 69
Figure 28. Environmental education at Zomba National Botanic Garden. Introducing the concept of the ecological approach in biodiversity conservation by using a web of life analogy. (Photo: Augustine Chikuni) 69
Figure 29. The *Aloe ex situ* conservation programme at Zomba National Botanic Garden. The aloes were collected from the wild with funding from SABONET. Exotic species were donated by friends of the Botanic Garden. (Photo: Augustine Chikuni) 70
Figure 30. Derelict glasshouses in the INIA Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis) 73
Figure 31. The large wooden greenhouse which serves as one of the central features of the Tunduru Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis) 75
Figure 32. Inside the Tunduru greenhouse. (Photo: Christopher Willis) 76
Figure 33. Manual cutting of the grass, University Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis) 77
Figure 34. Aloe garden, University Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis) 78
Figure 35. Display label for *Aloe parvibracteata*, University Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis) 79
Figure 36. The building housing the National Botanical Research Institute adjacent to the National Botanic Garden, Namibia. (Photo: Christopher Willis) 81
Figure 37. Quiver tree (*Aloe dichotoma*) forest, National Botanic Garden, Namibia. (Photo: Christopher Willis) 82
Figure 38. Hill slope dominated by *Aloe littoralis*, National Botanic Garden, Namibia. (Photo: Christopher Willis) 83
Figure 39. Recently constructed bridge, National Botanic Garden, Namibia. (Photo: Christopher Willis) 83
Figure 40. View of Durban Botanic Gardens with the skyscape of Durban in the background. (Photo: Durban Botanic Gardens) 85
Figure 41. Orchids in full bloom inside the orchid house, Durban Botanic Gardens. (Photo: Durban Botanic Gardens) 86
Figure 42. View of cycad garden. The Durban Botanic Gardens contain 48 of the 64 recognised species of *Encephalartos*. (Photo: Durban Botanic Gardens) 86
Figure 43. View of the palm area, Durban Botanic Gardens. (Photo: Durban Botanic Gardens) 87
Figure 44. *Erythrina zeyheri*, Free State National Botanical Garden. (Photo: Free State NBG) 88
Figure 45. *Rhus lancea*, Free State National Botanical Garden. (Photo: Free State NBG) 89
Figure 46. 'Hartbeeshuis', Medicinal Demonstration Garden, Free State National Botanical Garden. (Photo: Christopher Willis) 89
Figure 47. View of the Bird Hide, Free State National Botanical Garden. (Photo: Christopher Willis) 90
Figure 48. The entrance to the Harold Porter National Botanical Garden. (Photo: Karin Behr) 92
Figure 49. View of the restaurant and patio at the Harold Porter National Botanical Garden. (Photo: Karin Behr) 94
Figure 50. Bronze otters and ponds at the entrance, with the plant sales area in the background, Harold Porter National Botanical Garden. (Photo: Karin Behr) 95
Figure 51. Part of the nursery and office block at the Harold Porter National Botanical Garden. (Photo: Karin Behr) 96
Figure 52. Collection of *Haworthia* species in the Index nursery, Karoo Desert National Botanical Garden. (Photo: Christopher Willis) 97
Figure 53. A traditional cooking shelter or 'kookskerm', built by Namaqualanders according to a long regional tradition of indigenous architecture, Karoo Desert National Botanical Garden. A framework made from the branches of *Rhus pendulina* and *Acacia karroo* is

covered with reed mats made from *Cyperus marginatus* and *Scirpus* and *Juncus* species. The 1.5 m high barrier around the shelter and cooking area is made of brushwood harvested from species of *Ruschia* and *Stoeberia* or *Euphorbia mauritanica*. (Photo: Christopher Willis) 99
Figure 54. *Euphorbia ferox* (Euphorbiaceae) in the Great Karoo bed, Karoo Desert National Botanical Garden. (Photo: Christopher Willis) 99
Figure 55. Natural vegetation along the Shale trail, Karoo Desert National Botanical Garden. The Brandwacht Mountains can be seen in the background. (Photo: M.J. Wells) 100
Figure 56. Spring daisies next to the main lawn, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones) 101
Figure 57. The fragrance garden, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones) 102
Figure 58. Mesems provide a riot of colour in October, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones) 103
Figure 59. Looking down towards the Dell, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones) 105
Figure 60. A magnificent specimen of *Raphia australis*, Lowveld National Botanical Garden. (Photo: Rudi Britz) 106
Figure 61. Nursery facilities with *Encephalartos transvenosus* in the foreground. (Photo: Rudi Britz) 107
Figure 62. The Nelspruit Cascades, Lowveld National Botanical Garden. (Photo: Rudi Britz) 108
Figure 63. Part of the large cycad collection, Lowveld National Botanical Garden. (Photo: Rudi Britz) 109
Figure 64. Duck pond near the restaurant, Natal National Botanical Garden. (Photo: M.J. Wells) 111
Figure 65. London Plane Tree (*Platanus acerifolia*) Avenue, Natal National Botanical Garden. (Photo: Natal NBG) 112
Figure 66. Interpretive signage at the Zulu Muthi Garden, Natal National Botanical Garden. (Photo: Pitta Joffe) 113
Figure 67. Traditional hut used as an interpretive centre, Natal National Botanical Garden. (Photo: Pitta Joffe) 113
Figure 68. Pretoria Portland Cement (PPC)-sponsored artificial waterfall, Pretoria National Botanical Garden. (Photo: Christopher Willis) 114
Figure 69. Traditional use or 'muthi' garden, Pretoria National Botanical Garden. (Photo: Pitta Joffe) 115
Figure 70. Succulent area, Pretoria National Botanical Garden. (Photo: Pitta Joffe) 116
Figure 71. Reynolds Gate at the entrance to the Pretoria National Botanical Garden. (Photo: H. Joffe) 117
Figure 72. The Witpoortjie Waterfall forms the centrepiece of the Witwatersrand National Botanical Garden. (Photo: Sharon Turner) 119
Figure 73. Sign donated by the Black Eagle Project. (Photo: G. Heydenrych) 120
Figure 74. Entrance building with 'bokbaaivygies' (Mesembryanthemaceae). (Photo: Sharon Turner) 120
Figure 75. Water garden, Witwatersrand National Botanical Garden. (Photo: Sharon Turner) 122
Figure 76. Variegated *Furcraea foetida* 'Mediopicta' (Agavaceae), a native of the West Indies, cultivated as a specimen in an open bed in Munda Wanga Trust Botanical Garden, Chilanga, Zambia. The plant is here incorrectly labelled as *Agave americana*. (Photo: Gideon Smith) 126
Figure 77. Munda Wanga Trust. The Musamba Ngombe stream. (Photo: Douglas Gibbs) 127
Figure 78. Munda Wanga Trust. The top terrace. (Photo: Douglas Gibbs) 128
Figure 79. Munda Wanga Trust. The bird fountain. (Photo: Douglas Gibbs) 128
Figure 80. Map showing the different sections within the National Botanic Garden, Zimbabwe. (Photo: Christopher Willis) 130
Figure 81. Desert House, National Botanic Garden, Zimbabwe. (Photo: Christopher Willis) 131
Figure 82. Education Centre, National Botanic Garden, Zimbabwe. (Photo: Christopher Willis) 131
Figure 83. Forest section, National Botanic Garden, Zimbabwe. (Photo: Christopher Willis) 132

LIST OF TEXT BOXES

Box 1. Definition of a Botanical Garden (as accepted by the National Botanical Institute) 13
Box 2. The Millennium Seed Bank Project 26
Box 3. Garden Records Database System 41
Box 4. Twinning Southern Africa's Botanical Gardens 46
Box 5. *In Situ* Plant Conservation Activities 48
Box 6. Conservation of *Aloe peglerae* 49
Box 7. *Euphorbia* Described As New Species After 22 Years In Cultivation 49
Box 8. Reintroduction of the Endangered Stapeliad *Stapelia clavicorona* I. Verd. In the Soutpansberg 50
Box 9. *In Situ* Pollination of the Endangered Cycads *Encephalartos heenanii, E. dyerianus* and *E. middelburgensis* 50
Box 10. Training of Law Enforcement Officers In the Identification of Endangered Plant Taxa 52
Box 11. Past and Present Curators of Selected Southern African Botanic(al) Gardens 123

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FOREWORD

I was very pleased to be asked to contribute a foreword for this important new review of southern Africa's botanic gardens, not only because it provides an extremely useful update of information since the last edition of the *International Directory of Botanical Gardens* (1990) but also because it is a valuable model that could be used by botanic gardens in other parts of the world.

Tens of thousands of plant species and the wild habitats in which they grow are threatened throughout the world. Botanic gardens are at the forefront of efforts being made to document and safeguard plant diversity. There are now very few countries in the world without at least one botanic garden, as more governments recognise that botanic gardens must be part of the suite of facilities and resources they require if their biodiversity is to be safeguarded. Accordingly, botanic gardens recognise that there are important tasks that they must now undertake in conservation and sustainable use of plant resources and in raising public awareness of how vital plants are to our everyday lives. Nevertheless, the distribution of botanic garden resources around the world does not correlate well with the regions with the greatest diversity or those facing the most urgent threats. For that reason, great efforts are needed to develop and strengthen new and existing botanic gardens in many parts of the world, particularly in the tropics and many Mediterranean regions. The efforts that are being made to support botanic gardens in southern Africa are therefore greatly welcomed, initially by assessing their current state and resources and to highlight future needs.

Reading through this needs assessment, it is clear that a great diversity of institutions exists in the region, each one with a unique set of needs, opportunities and responsibilities. Nevertheless, there are several priority areas that are apparent where close networking and mutual support will make a considerable impact on the ability of botanic gardens to achieve their missions. These priority areas include training programmes in institutional management and development, conservation, education and horticultural programmes, the development of effective data recording and information management systems and effective and closer communications between botanic gardens. A further priority must surely be to find ways to increase the number of people who visit botanic gardens throughout southern Africa so that the message of the need for plant conservation can be spread to an ever-growing audience.

The preparation and recent publication of a new global strategy for botanic gardens, the *International Agenda for Botanic Gardens in Conservation*, to which SABONET contributed so effectively, has helped to establish shared targets for botanic gardens worldwide in many aspects of conservation. This needs assessment represents an important contribution and step towards the achievement of this global strategy for botanic gardens. Finding ways in which we can, together, meet these needs, will be the crucial task for us in the years ahead.

Peter S. Wyse Jackson
Secretary General
Botanic Gardens Conservation International
July 2000

ABBREVIATIONS

a.s.l.	above sea level
ANPC	Australian Network for Plant Conservation
b.	born in
BGCI	Botanic Gardens Conservation International
BRI	Botanical Research Institute
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CFR	Cape Floristic Region
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EE	Environmental Education
EIA	Environmental Impact Assessment
GEF	Global Environment Facility
INIA	National Institute of Agronomic Research
IUCN ROSA	World Conservation Union (Regional Office for Southern Africa)
LHDA	Lesotho Highlands Development Authority
N.D. Hort.	National Diploma in Horticulture
NBG	National Botanic(al) Garden(s)
NBI	National Botanical Institute
NBRI	National Botanical Research Institute
NBSAP	National Biodiversity Strategy and Action Plan
NUL	National University of Lesotho
PRECIS	National Herbarium (PRE) Computerised Information System
RAMSAR	Convention on Wetlands
SABONET	Southern African Botanical Diversity Network
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WWF	World Wide Fund for Nature

Herbarium Acronyms

GAB	National Herbarium, Gaborone, Botswana
GKAR	Karoo Desert National Botanical Garden Herbarium, Worcester, South Africa
GLOW	Lowveld National Botanical Garden Herbarium, Nelspruit, South Africa
GOFS	Free State National Botanical Garden Herbarium, Bloemfontein, South Africa
J	C.E. Moss Herbarium, Johannesburg, South Africa
LMA	INIA Herbarium, Maputo, Mozambique
LMU	Eduardo Mondlane University Herbarium, Maputo, Mozambique
MAH	Herbarium, Department of Agricultural Research, Gaborone, Botswana
MAL	National Herbarium, Zomba, Malawi
MRSC	Mount Makulu Herbarium, Chilanga, Zambia
NBG & SAM	Compton Herbarium, Cape Town, South Africa
NH	Natal Herbarium, Durban, South Africa
NU	Bews Herbarium, University of Natal, Pietermaritzburg, South Africa
PRE	National Herbarium, Pretoria, South Africa
ROML	National University of Lesotho Herbarium, Roma, Lesotho
SRGH	National Herbarium, Harare, Zimbabwe
UCBG	University of Botswana Herbarium, Gaborone, Botswana
UZL	University of Zambia Herbarium, Lusaka, Zambia
WIND	National Herbarium, Windhoek, Namibia

EXECUTIVE SUMMARY

The network of southern African plant scientists developed as a result of the GEF/UNDP and USAID/IUCN ROSA-funded SABONET project has proved to be an important mechanism for cooperation, collaboration and capacity-building amongst botanists in the ten countries of southern Africa. Although many of the details still need to be worked out by the countries and participating institutions concerned, SABONET could, at least for the duration of the project, serve as the coordinating body for a regional network of botanical gardens in southern Africa. Preliminary results of this regional botanical gardens needs assessment have indicated that the staff attached to those gardens surveyed have relatively similar needs in terms of training, computerisation of plant records and general botanical garden management. These needs can be addressed by tailor-made training courses and workshops developed and conducted within the region. Closer collaboration, however, needs to be developed with national universities, herbaria and conservation agencies, as well as with the BGCI and other gardens and networks around the world.

INTRODUCTION

This report represents the results of the first needs assessment of southern Africa's botanical gardens. The gardens survey was conducted between July 1998 and December 1999, following the request and approval of the necessary funds by the Southern African Botanical Diversity Network's (SABONET) Steering Committee at its fifth meeting, held in Gaborone, Botswana, on 27 April 1998. Following the decision, mechanisms were put in place for personal visits to the region's national botanical gardens by the authors, together with individual curators (where available) of South Africa's National Botanical Gardens. In addition to those gardens surveyed outside South Africa, South Africa's eight National Botanical Gardens and the Durban Botanic Gardens were surveyed through correspondence during 1999/2000. Preliminary results of the gardens needs assessment were presented in earlier editions of SABONET's newsletter, *SABONET News* (Willis, Botha & Winter 1998, 1999). The needs assessment was conducted with the aim of determining the needs of and gathering first-hand information about the various botanical gardens in the region. The needs, particularly with regards to training, will be used to design a tailor-made Botanical Gardens Management Course for garden staff within the southern African region. This will form part of SABONET's capacity-building activities within the region (Huntley, Matos, Aye, Nermark, Nagendran, Seyani, da Silva, Izidine, Maggs, Mannheimer, Kubirske, Smith, Koekemoer, Dlamini, Phiri, Nobanda & Willis 1998).

SABONET has already produced several recent publications concerning the status of botanical resources in the southern African region, publishing a status report on southern Africa's national herbaria in March 1997 (Willis 1997), as well as the results of a needs assessment of 55 southern African herbaria conducted by Gideon Smith and Christopher Willis during 1998 and 1999 (Smith, Willis & Mössmer 1999). In addition, SABONET has also published two editions of *Index herbariorum: southern African supplement* (Smith & Willis 1997, 1999a); the second edition covers 95 herbaria in the region. A directory of southern African plant taxonomic and diversity expertise was published in July 2000 (Mössmer & Willis 2000). Whilst up-to-date information on southern Africa's herbaria is now readily accessible, little has been written or published about southern Africa's botanical gardens, particularly those outside South Africa. A manual on environmental interpretation in botanical gardens has, however, recently been published by SABONET (Honig 2000).

This report builds upon information about southern Africa's botanical gardens published in the *International Directory of Botanical Gardens* (Heywood, Heywood & Wyse Jackson 1990), and is a first attempt at synthesizing the information available on southern Africa's botanical gardens in a single publication, as well as publishing the needs of selected botanical gardens in the region. It is anticipated that this information can, and will, be used by national botanical gardens within the region to source their own funding.

Box 1. Definition of a Botanical Garden
(as accepted by the National Botanical Institute)

A botanical garden is an institution where plants are grown and displayed for the purpose of research, conservation, education and recreation in order to promote an understanding, love and appreciation of the diversity of plant life.

The database of southern African botanical gardens developed during this survey, as well as the rest of the publication, will be added to SABONET's dedicated web site (http://www.sabonet.org) in due course. Curators and staff of the surveyed botanical gardens are encouraged to inform the SABONET Regional Coordinator of any changes to the garden-specific information contained in this publication. In this way, the database can be kept current. The Regional Coordinator can be contacted at the following address:

SABONET Regional Coordinator
c/o National Botanical Institute
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PART 1.

Summary of Needs

Scope

Twenty botanical gardens within southern Africa were surveyed in the following countries: Botswana (1), Lesotho (1), Malawi (3), Mozambique (3), Namibia (1), South Africa (9), Zambia (1) and Zimbabwe (1). This is not an exhaustive coverage of all the botanical gardens in the region, but the needs that have been expressed by the gardens surveyed would most probably be applicable to those few gardens within the region that were not included in the survey, particularly in terms of training needs. Most of the botanical gardens surveyed included a high percentage of indigenous plants, generally greater than 90%. The botanical gardens with the greatest percentage of exotic plants were Durban Botanic Gardens (30% indigenous), Munda Wanga Trust Botanical Garden (30% indigenous) and Tunduru Botanical Garden (unknown percentage, but predominantly exotic).

Status

Of the gardens surveyed, eight gardens were state owned, nine were parastatal, including all of South Africa's National Botanical Gardens, two were municipal and one was attached to a university.

State-owned
National Botanical Garden (Botswana)
Lilongwe National Botanic Garden (Malawi)
Mzuzu National Botanic Garden (Malawi)
Zomba National Botanic Garden (Malawi)
INIA Botanical Garden (Mozambique)
National Botanic Garden (Namibia)
Munda Wanga Trust Botanical Garden (Zambia)
National Botanic Garden (Zimbabwe)

Parastatal
Katse Botanical Garden (Lesotho)
Free State National Botanical Garden (South Africa)
Harold Porter National Botanical Garden (South Africa)
Karoo Desert National Botanical Garden (South Africa)
Kirstenbosch National Botanical Garden (South Africa)
Lowveld National Botanical Garden (South Africa)
Natal National Botanical Garden (South Africa)
Pretoria National Botanical Garden (South Africa)
Witwatersrand National Botanical Garden (South Africa)

Municipal
Tunduru Botanical Garden (Mozambique)
Durban Botanic Gardens (South Africa)

University
Eduardo Mondlane University Botanical Garden (Mozambique)

Date of Foundation

Of the gardens surveyed, four were founded in the 1800s (Durban Botanic Gardens, Zomba National Botanic Garden, Tunduru Botanical Garden and the Natal National Botanical Garden), whilst more than 50% of the surveyed gardens were founded in the four-decade period 1960–1999

(Figure 1). Four gardens were founded in the 1960s, followed by three in the 1970s and 1980s. The youngest botanical garden surveyed was Lesotho's Katse National Botanical Garden, founded in 1995.

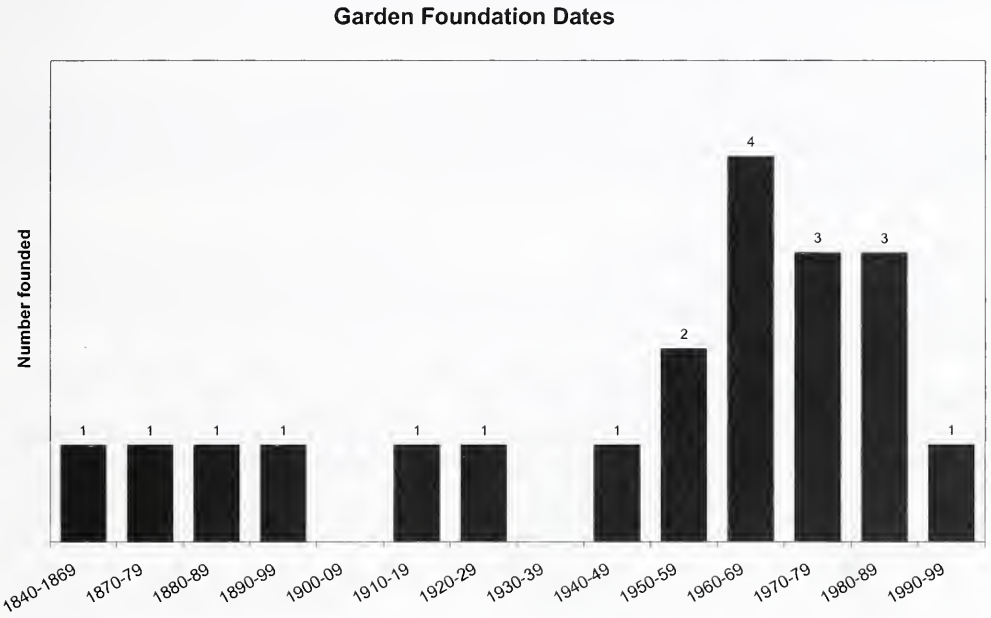

Figure 1. Number of gardens founded over the last 160 years. More than 50% of the gardens were founded between 1950 and 1980.

Mission

The missions of the various botanical gardens surveyed were as follows:

National Botanical Garden (Botswana)
Under development.

Katse Botanical Garden (Lesotho)
Katse Botanical Garden strives to promote a better knowledge and understanding of the alpine flora of Lesotho through propagation, cultivation and conservation of the indigenous plants, and serve as an educational centre for local communities, students, scientists and the public at large.

Lilongwe National Botanic Garden (Malawi)
To develop the Lilongwe National Botanic Garden to serve conservation, education, recreation, training and research in native and exotic species.

Mzuzu National Botanic Garden (Malawi)
To develop the Mzuzu National Botanic Garden to serve conservation, education, recreation, training and research in native and exotic species.

Zomba National Botanic Garden (Malawi)
To develop the Zomba National Botanic Garden to serve conservation, education, recreation, training and research in native and exotic species.

INIA Botanical Garden (Mozambique)
None available.

Tunduru Botanical Garden (Mozambique)
To introduce exotic and indigenous species.

University Botanical Garden (Mozambique)
The University Botanical Garden aims to serve as a reference botanical garden in Mozambique, involved with the promotion and conservation of Mozambican plants, especially the most used plant species and species of concern. This botanical garden also envisages the promotion of education and research in botany and related fields.

National Botanic Garden (Namibia)
The National Botanic Garden of Namibia strives to protect and promote the sustainable utilisation of the Namibian flora and to function as an educational and recreational nature facility for Namibians and visitors alike.

Durban Botanic Gardens (South Africa)
- To develop and curate conservation-significant collections of African cycads, palms and orchids.
- To maintain the existing assemblage of plants while promoting the flora of Africa.
- To cultivate regional and international links with the botanic gardens conservation community.
- To demonstrate the role plants can play in social upliftment, by teaching organic gardening techniques.
- To awaken public appreciation of the gardens through environmental education.
- To maintain the gardens as a peaceful haven for visitors, and as one of Durban's heritage sites.

Free State National Botanical Garden (South Africa)
The Free State National Botanical Garden strives to become the pivot of knowledge, display, information, education and enjoyment of the flora of central South Africa.

Harold Porter National Botanical Garden (South Africa)
To provide the facilities, knowledge and expertise necessary to ensure the conservation, sustained use, appreciation and enjoyment of the exceptionally rich flora and vegetation found in the mountain and coastal fynbos of the southwestern Cape.

Karoo Desert National Botanical Garden (South Africa)
To cultivate, display and promote South Africa's arid flora as well as the flora of southern Namibia.

Kirstenbosch National Botanical Garden (South Africa)
To establish, develop and maintain dynamic collections of southern African plants.

Lowveld National Botanical Garden (South Africa)
To excel in growing, displaying and conserving living plant collections of the lowland areas of southern Africa with a special emphasis on trees, cycads and ecological areas.

Natal National Botanical Garden (South Africa)
To excel in growing, displaying and conserving living plant collections of the grasslands of the east coast region of southern Africa for horticultural, educational and scientific purposes.

Pretoria National Botanical Garden (South Africa)
Through aesthetic displays, the Pretoria NBG cultivates and promotes extensive existing collections, as well as the flora of the African savannah and Afromontane forests, best suited to

the climate of Pretoria. This is supported by active research, education and information programmes.

Witwatersrand National Botanical Garden (South Africa)
To work together to create a beautiful and safe environment where the staff strive to conserve and promote South Africa's rich plant life through education and friendly service.

Munda Wanga Trust Botanical Garden (Zambia)
The Munda Wanga Trust will exhibit and care for indigenous and exotic animals and plants in order to foster understanding, knowledge, research, care and appreciation of our biological heritage and associated ecological considerations, for the benefit of the community at large.

National Botanic Garden (Zimbabwe)
To increase knowledge and appreciation of Zimbabwean plants, their identity, distribution, uses, conservation and cultivation, through displaying and managing the living collections.

As can be seen from the statements listed here, most of the botanical gardens surveyed do have missions to guide their development and activities. Several gardens do not have missions, and urgent efforts should be made by these specific gardens to develop missions through a consultative and participatory process. It is indeed difficult for gardens to stay focussed, particularly in terms of their development, without a mission to guide the process.

Size of Garden

The botanical gardens surveyed vary greatly in size (Figure 2). Most of the gardens have both landscaped and natural areas within their boundaries. The sum total of the landscaped area in the botanical gardens surveyed was 332 ha, compared with a total of 1994 ha of natural vegetation. The largest natural areas were included within Mzuzu National Botanic Garden in northern Malawi (472 ha), followed by Kirstenbosch National Botanical Garden (470 ha) and the Witwatersrand National Botanical Garden (280 ha) in South Africa. Of the gardens with natural areas, 97% of natural vegetation is found in the 11 botanical gardens in Malawi (3; 30%) and South Africa (8; 67%). Gardens with the largest landscaped areas were South Africa's Pretoria National Botanical Garden (50 ha), followed by Zimbabwe's National Botanic Garden (48 ha), South Africa's Kirstenbosch National Botanical Garden (38 ha) and Malawi's Zomba and Lilongwe National Botanic Gardens (each 30 ha). Approximately 60% of the landscaped area in the botanical gardens surveyed was spread amongst these four gardens. South Africa's eight National Botanical Gardens together comprise 1 340 ha of natural vegetation. Malawi's network of three national botanic gardens together comprise 593 ha of natural vegetation.

Altitude and Rainfall

In terms of altitude, southern Africa's botanical gardens range from sea level (Durban Botanic Gardens, Harold Porter National Botanical Garden and Eduardo Mondlane University Botanical Garden) to 2 150 m a.s.l. (Katse Botanical Garden, Lesotho)(Figure 3). Several botanical gardens have a large topographical variation, for example the Harold Porter National Botanical Garden (15–360 m), the Karoo Desert National Botanical Garden (300–525 m) and Kirstenbosch National Botanical Garden (100–1 086 m), all three of which are in South Africa.

Southern Africa's botanical gardens are also variable in terms of the annual rainfall received (Figure 4). Most surveyed gardens receive between 750 and 1 500 mm rainfall per annum; the

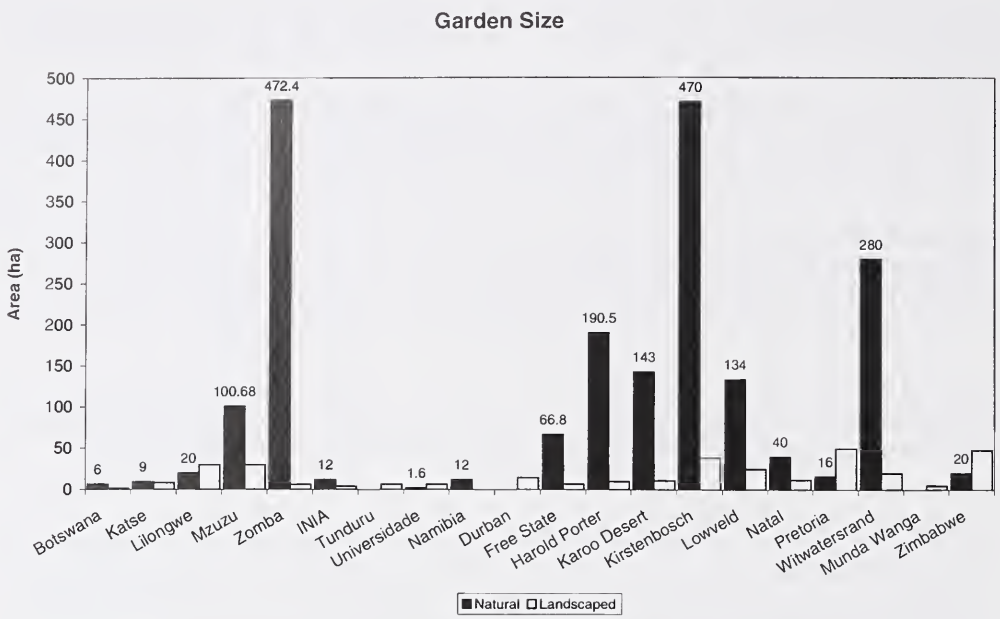

Figure 2. Garden size. Most gardens have both landscaped and natural areas.

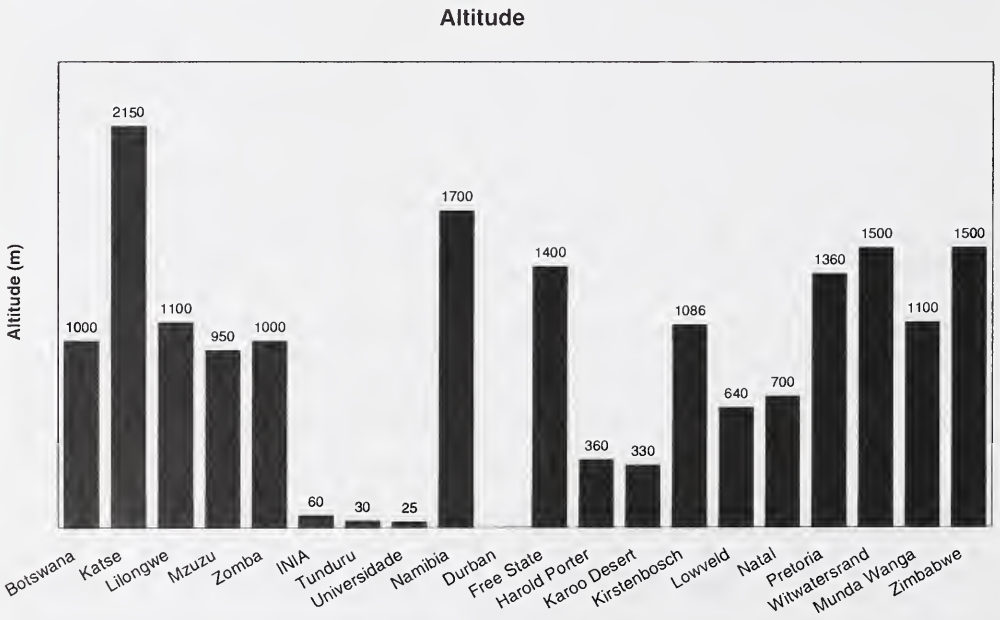

Figure 3. Altitude. Southern Africa's gardens range from sea level to 2 150 m a.s.l. For gardens that have a wide range in altitude, the highest value was used in this chart.

botanical garden that receives the highest annual rainfall was Malawi's Mzuzu National Botanic Garden (3 000 mm per annum). Three gardens stand out as distinctly "arid" gardens, namely Botswana's National Botanical Garden (400–450 mm), Namibia's National Botanic Garden (360 mm) and probably the driest botanical garden in southern Africa, the Karoo Desert National Botanical Garden (250 mm per annum) in Worcester, South Africa.

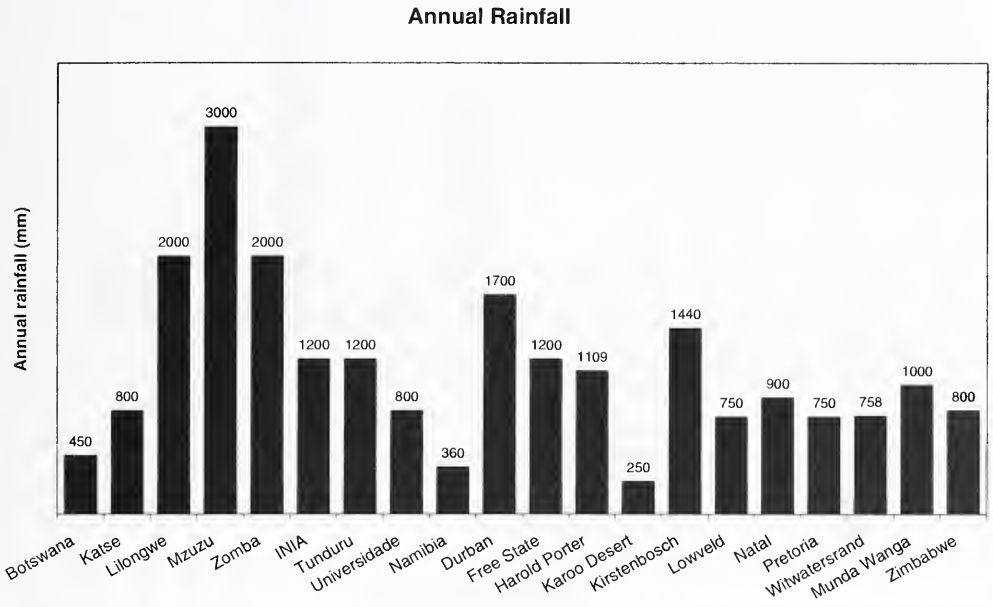

Figure 4. Annual rainfall. Rainfall ranges from 250 mm to 3 000 mm, with most gardens receiving between 750 mm and 1 500 mm.

Visitors

The number of visitors received per annum by the botanical gardens surveyed was highly variable, ranging from 200 per annum (botanical gardens in Lesotho, Mozambique and Namibia) to 680 000 per annum at Kirstenbosch National Botanical Garden (Figure 5). South Africa's network of eight National Botanical Gardens receives an annual total of over one million visitors per annum, more than half of which are received by Kirstenbosch. South Africa's National Botanical Gardens and the municipal Durban Botanic Gardens together receive 96.7% of all visitors received by the 20 botanical gardens surveyed. The only other gardens outside South Africa's National Botanical Gardens that receive more than 10 000 visitors per annum are Zimbabwe's National Botanic Garden (30 000) and Zambia's Munda Wanga Trust Botanical Garden (up to 20 000 per annum) in Chilanga.

Staff

The largest number of paid garden staff is found in Kirstenbosch National Botanical Garden (145), followed by Pretoria National Botanical Garden (81), Tunduru Botanical Garden (58), Lowveld National Botanical Garden (42), Witwatersrand National Botanical Garden and Durban Botanic Gardens (both 39)(Figure 6). The same order is shown in terms of labour staff numbers in the surveyed botanical gardens (Figure 6). For horticulturists, Kirstenbosch has the highest number (15), followed by Pretoria National Botanical Garden (4), Zimbabwe's National Botanic Garden (3) and the Witwatersrand National Botanical Garden (Figure 6).

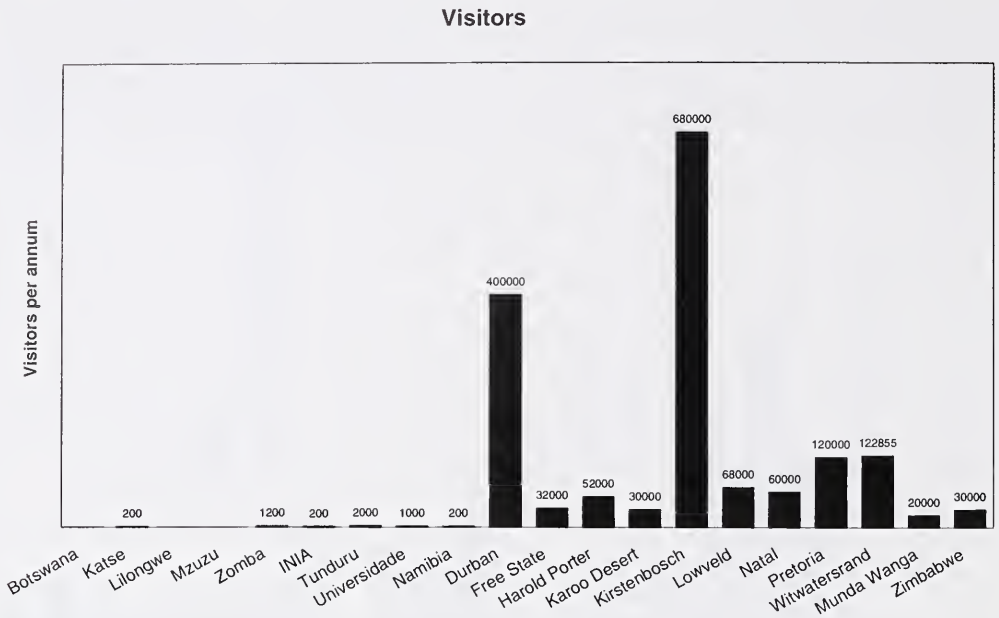

Figure 5. Number of vistors per annum. Visitor numbers are highly variable, ranging from 200 to 680 000 per year. South Africa's National Botanical Gardens receive an annual total of over one million visitors.

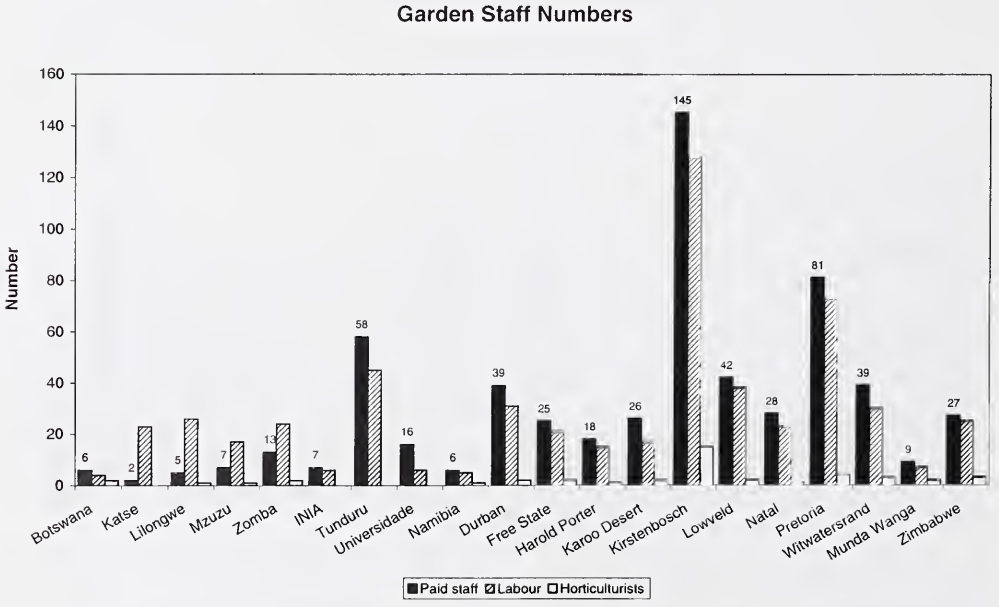

Figure 6. Number of paid garden staff, showing total garden staff, labour staff, and horticulturists.

Absolute numbers, however, can be misleading, and when one takes the garden areas into account, a very different picture emerges. Using only the number of horticultural staff, Botswana's National Botanical Garden, with only one hectare of landscaped garden, has two horticulturists for that one hectare of landscaped area. This is a very high figure compared with the other gardens in the region (Figure 7). Pretoria National Botanical Garden, for example, although it has the second highest number of horticulturists, has only 0.08 horticulturists per hectare of landscaped garden (Figure 7). If one includes the total garden area, the number necessarily decreases, except for the Munda Wanga Trust Botanical Garden (0.4) and Durban Botanic Gardens (0.14), both of which have only landscaped area and no natural vegetation in the gardens (Figure 7). The figure for Botswana's National Botanical Garden drops drastically (from 2 to 0.29), whilst that of Kirstenbosch changes from 0.39 to 0.03. It is noticeable that none of the botanical gardens in Mozambique employ any horticulturists. This is also the case for the Katse Botanical Garden in Lesotho (Figure 7).

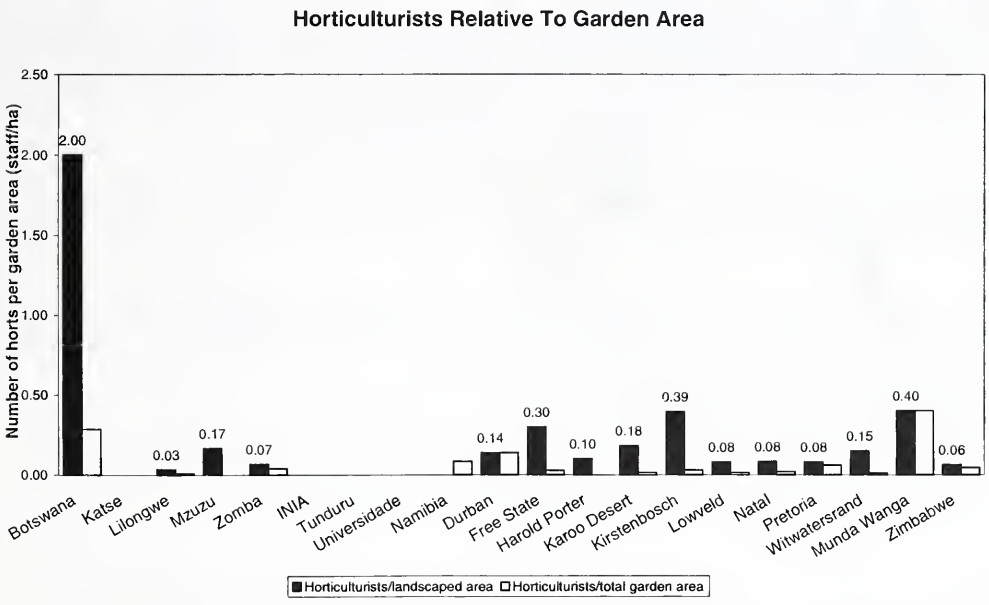

Figure 7. Number of horticulturists relative to landscaped area and total garden area. Note the high value for Botswana's National Botanical Garden

Regarding total paid staff per garden, the Tunduru Botanical Garden in Mozambique appears to be over-staffed, with nine paid staff per hectare of garden, and seven labour staff per hectare of garden (Figure 8). Other gardens with more than one paid staff member per hectare include South Africa's Durban Botanic Gardens, Zambia's Munda Wanga Trust Botanical Garden, the University Botanical Garden in Mozambique, and Pretoria National Botanical Garden in South Africa (Figure 8). For labour staff, the four gardens which have more than one staff member per hectare include Mozambique's Tunduru Botanical Garden (7.03), South Africa's Durban Botanic Gardens (2.14), Zambia's Munda Wanga Trust Botanical Garden (1.4), Lesotho's Katse Botanical Garden (1.35) and South Africa's Pretoria National Botanical Garden (1.11)(Figure 8). Malawi's Zomba National Botanic Garden uses up to 60 additional casual staff during the rainy season.

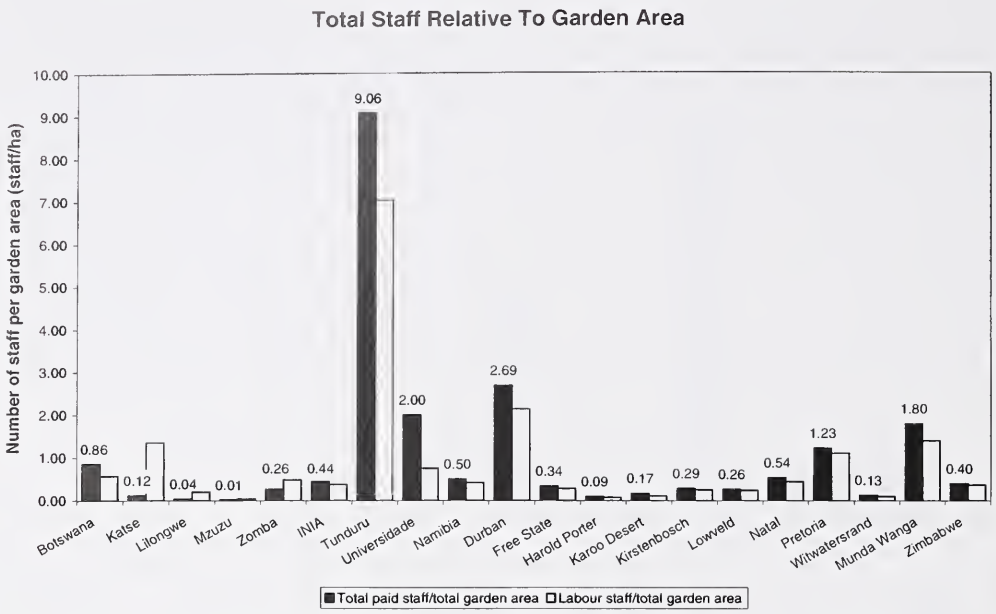

Figure 8. Number of paid garden staff and labour staff relative to total garden area. Note the high values for Tunduru Botanical Garden.

Relatively few of the gardens surveyed reported making use of volunteer staff. The gardens which did indicate the use of volunteers were as follows:

- Kirstenbosch National Botanical Garden, South Africa (100–200)
- Durban Botanic Gardens, South Africa (25)
- Harold Porter National Botanical Garden, South Africa (28)
- Karoo Desert National Botanical Garden, South Africa (one permanent and up to 12 per annum)
- Pretoria National Botanical Garden, South Africa (variable number)
- National Botanic Garden, Zimbabwe (3)

Nurseries and Greenhouses

All of the gardens surveyed, except the Munda Wanga Trust Botanical Garden (where a nursery is being planned) reported having at least one nursery area. The Karoo Desert National Botanical Garden in South Africa had the highest number of nurseries (3), followed by the Kirstenbosch and the Lowveld National Botanical Gardens, each with two nurseries (Figure 9).

The number of greenhouses or propagation structures within the region was more variable, ranging from 27 at Kirstenbosch to none in the Katse Botanical Garden (planned), Mzuzu National Botanic Garden and Botswana's National Botanical Garden (Figure 9). Considering the altitude at which the Katse Botanical Garden is located, and the fact that snow often falls during the cold winter months, the construction of a greenhouse attached to the garden should be considered a priority.

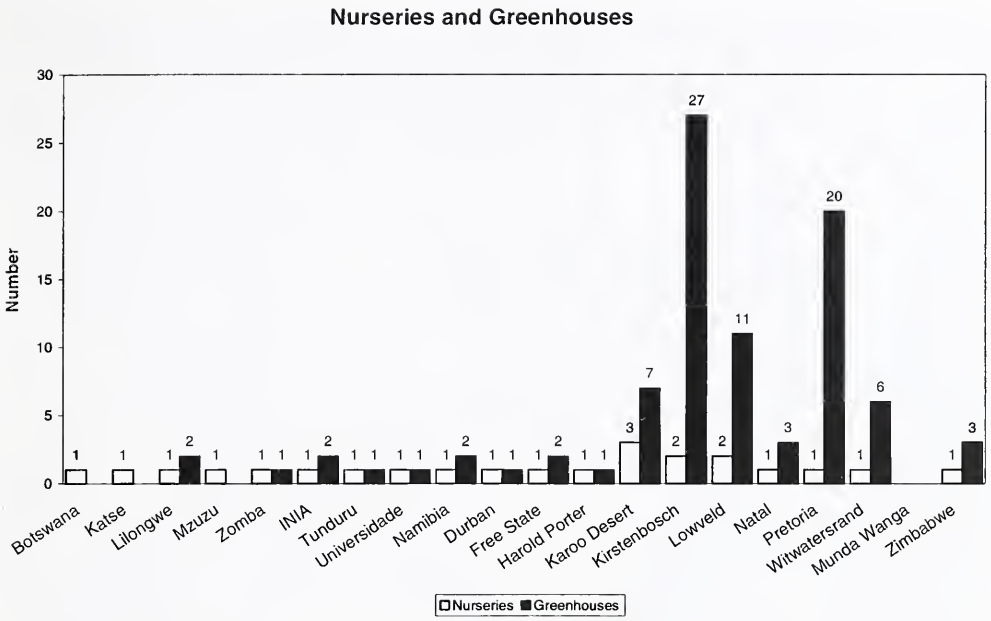

Figure 9. Number of nurseries and greenhouses. The South African National Botanical Gardens are relatively well equipped.

Seed Bank

Ex situ seed collection and storage in seed banks is the most convenient and widely used method of genetic conservation (Olsen & Arnklit 1979; Thompson 1979; Hawkes 1990; Maxted, Ford-Lloyd & Hawkes 1997). In such banks, many species can be preserved in a small area and hybridisation is precluded except when the plants are propagated (Raven 1981). Most of the botanical gardens surveyed do not have seed banks, although several gardens, such as Katse Botanical Garden (Lesotho) and the INIA Botanical Garden (Mozambique), indicated that the national gene bank in the country is used to store seed. Whether or not the seed banks attached to the national gene banks hold collections of seeds from taxa cultivated in the botanical gardens, is uncertain. Unlike botanical gardens, national gene banks in southern Africa have traditionally focussed on crop or crop-related species. Seed banks attached to national gene banks are often located far from the botanical gardens and there is relatively little formal collaboration between the different institutions. Gardens located close to national gene banks include Malawi's Zomba National Botanic Garden, the INIA Botanical Garden in Mozambique and Namibia's National Botanic Garden.

When selecting seed for storage, care should be taken to ascertain whether the seeds are "orthodox" or "recalcitrant"; orthodox seeds can survive drying and can be stored frozen, whereas recalcitrant seeds, including the seeds of many tropical trees, cannot survive drying and cannot be stored frozen (Guerrant & McMahon 1995). Seed banks, like the collections of living plants in the botanical gardens themselves, must be set up according to clearly defined principles if they are to be successful. According to Raven (1981), seed banks may be especially suitable for dealing with annuals, many of which have "highly resistant seeds".

Box 2. The Millennium Seed Bank Project

by Erich van Wyk, National Botanical Institute, Private Bag X101, Pretoria 0001, South Africa

The Millennium Seed Bank Project, a joint venture by the Royal Botanic Gardens, Kew, UK, and various institutions from countries around the world, aims to safeguard 10% of the world's plant species through the conservation of their seeds. The seeds will be stored in a new facility, the Welcome Trust Millennium Building, housing the seed vaults, at Wakehurst Place in Sussex, UK. South Africa's National Botanical Institute (NBI), the lead agent in indigenous plant research and *ex situ* conservation, aims to contribute to this international conservation project. Over the next ten years the NBI aims to contribute up to 3 000 indigenous species towards an international total of over 24 000 species to be safeguarded by the Millennium Seed Bank. The majority of the species will be plants being over-exploited by humans and therefore likely to be extinct in the future as well as those plants in need of protection either because of their threatened status (i.e. rare and endangered species) or restricted distribution (endemic species). Species are collected from all over South Africa with particular interest in threatened habitats, areas of high biodiversity and areas of high endemism. With this diverse and monumental task in mind, the extensive knowledge and experience of an existing network of specialists continuously extending the living collections in South Africa's National Botanical Gardens could prove to be very valuable towards the success of this project. As an important means of supporting *in situ* conservation techniques, *ex situ* conservation should—whether it is as living collections or seed in a seed bank—be considered a very high priority for ensuring the survival of South Africa's indigenous flora.

Although the NBI does not, at this stage, plan to create its own seed bank, the Royal Botanic Gardens, Kew, will provide long-term duplicate storage of seeds. The NBI will therefore at any time have the opportunity to bring an agreed portion of the seed back into the country to be stored in the National Seed Bank or another suitable storage facility.

In Vitro Storage

In vitro conservation involves the maintenance of explants in a sterile, pathogen-free environment and is widely used for vegetatively propagated and recalcitrant-seeded species (seeds which even under moist storage have a very short life and are not able to withstand dessication)(Bramwell 1997). "It involves the establishment of tissue cultures of accessions on nutrient agar and their storage under controlled conditions of either slow or suspended growth. The main advantage is that it offers a solution to the long-term conservation problems of recalcitrant, sterile or clonally propagated species. The main disadvantage is the risk of somaclonal variation, the need still to develop individual maintenance protocols for the majority of species and the relatively high-level technology and cost required. The best answer for cheap, long-term *in vitro* conservation in the future may be cryopreservation; that is, the storage of frozen tissue cultures at very low temperatures, for example in liquid nitrogen at -196°C." (Maxted *et al.* 1997).

Cryopreservation provides an alternative to seed banks for many tropical trees and other plants that have recalcitrant seeds (Fay 1996), or for plants that produce little or no seed (see Meney 1997). Despite it being species dependent, cryopreservation should be considered as an option for the long-term storage of threatened southern African plant species. Touchell and Dixon (1993, 1994) have indicated that at least 40% of Western Australia's rare and endangered

species could be maintained through the cryostorage of seed. Before cryostorage can be implemented as a general conservation tool, however, optimal moisture contents and freezing protocols need to be assessed and developed to ensure maximum survival of the seed for that species (Touchell & Dixon 1993). Namibia's National Botanic Garden mentioned that Namibia's National Gene Bank is involved with *in vitro* conservation, although this is probably not related to the activities or specific needs of the garden.

Micropropagation (the *in vitro* propagation of small quantities of plant tissue) is increasingly helping botanical gardens to multiply rare plants in their collections. The Micropropagation Unit at the Royal Botanic Gardens, Kew, UK, has used *in vitro* laboratory techniques to propagate several southern African succulent plants, including the endangered *Gasteria baylissiana* from the Karoo, South Africa (Fay 1996; see van Jaarsveld 1991, 1994, 1999), and *Aloe polyphylla* from the mountains of Lesotho (Townsend 1979; Fay & Muir 1990; Fay 1996; Mothepu 1997; Smith & Willis 1999b). Although most botanical gardens in southern Africa do not have the equipment necessary for micropropagatation, it is often possible that links can be developed with nearby universities or research institutes that do.

Pollen Bank

Durban Botanic Gardens indicated having a pollen bank for cycads, whilst Kirstenbosch National Botanical Garden, although it does not have an official pollen bank *per se*, does store pollen of the Orchidaceae and *Encephalartos* (Zamiaceae) for short periods of time. None of the other gardens surveyed have pollen banks. According to Maxted *et al.* (1997), the advantage of pollen conservation is that it is a relatively low-cost option, "but the disadvantage is that only paternal material is conserved and regenerated."

DNA Storage

None of the southern African gardens surveyed store DNA under controlled conditions. The advantage of the storage of DNA in appropriate conditions is that it is efficient and simple, but the disadvantage "lies in problems with subsequent gene isolation, cloning and transfer" (Maxted *et al.* 1997).

Research

Research is recognised as one of the most important functions of botanical gardens, and one of the main factors that distinguish botanical gardens from public parks (Stearn 1971; Raven 1981; McCracken 1996). Most of southern Africa's botanical gardens conduct some research, although most of this research remains largely unpublished and therefore inaccessible to other botanical gardens in the region. Greater attention should be given within the next few years to finding ways to share the research results (horticulture, propagation and cultivation of indigenous species, medicinal plants, amongst many other research areas) that emanate from southern African botanical gardens and associated nurseries. Many of southern Africa's botanical gardens include large areas of natural vegetation that could be used to conduct research.

An example of where horticultural research results have been made available is the publication of the *Kirstenbosch Gardening Series* by South Africa's National Botanical Institute. Eight numbers in this series have so far been published, namely *Grow Bulbs*, *Grow Proteas*, *Grow Agapanthus*, *Grow Restios*, *Grow Cycads*, *Grow Succulents*, *Grow Clivias* and *Grow South African Plants*. This series includes notes and basic information on the cultivation and propagation of South Africa's indigenous flora.

Every effort should be made by southern Africa's botanical gardens to document and map their collections. The actual number of plant taxa growing naturally or being cultivated (Figure 10) in the region's botanical gardens, as well as the number of threatened plant taxa in cultivation (Figure 11) is still largely unknown. These should be considered priority areas for attention by regional botanical garden staff over the next few years. The computerisation of records should also be seen as a priority, ideally in an internationally accepted format, so that the living collections can be used by *bona fide* investigators. Duplication of inventories not yet computerised (and regular back ups of computerised records) should be undertaken to avoid the possible destruction of records by fire or natural disasters. Consideration should also be given to off-site storage of garden record databases.

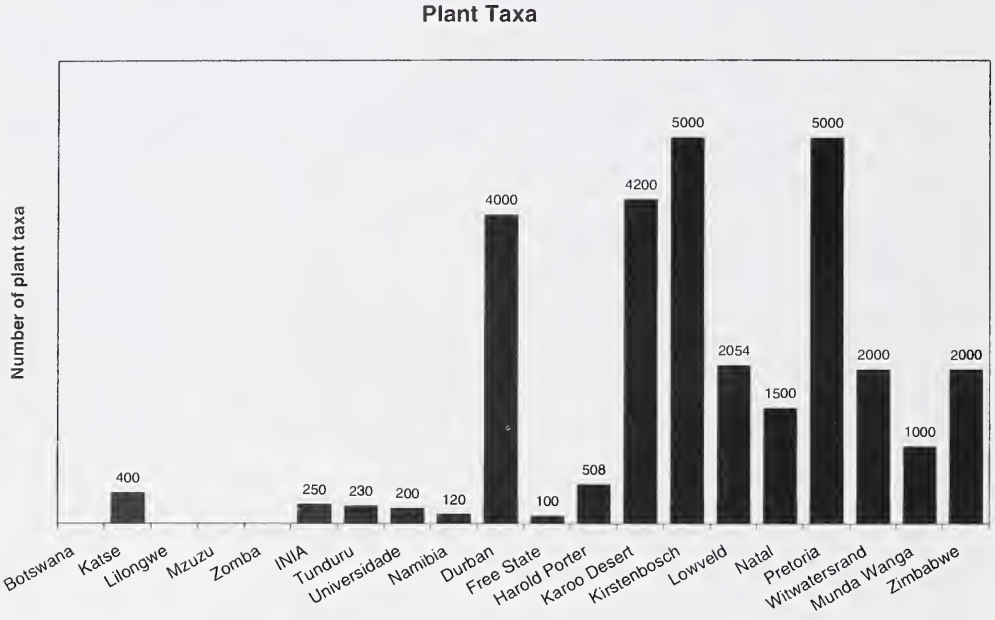

Figure 10. Number of plant taxa. Some gardens could not specify the number of plant taxa.

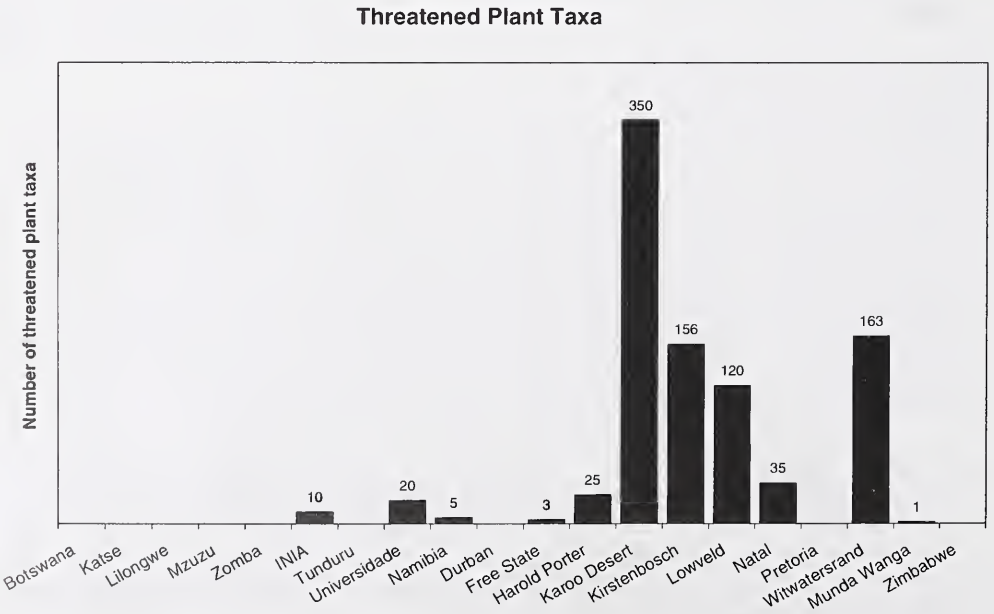

Figure 11. Number of threatened plant taxa. Almost half the gardens do not have any threatened taxa.

Environmental Education

It is generally recognised that one of the fundamental roles of botanical gardens is to play an active role in environmental education at all levels, making the public aware of the importance of botanical conservation (Bramwell 1979; Rycroft 1983; Maxted *et al.* 1997).

Interpretation within botanical gardens should be used to promote the understanding of plants, the need for conservation and the aims of the institution involved (Simmons 1981). The recent SABONET-supported publication on environmental interpretation in botanical gardens by Honig (2000) illustrates very clearly the role of environmental interpretation in making gardens more informative and useful to visitors. Simmons (1981) provides some useful ideas, advice and guidelines for developing information systems in botanical gardens. Strong ties should be developed and maintained between southern African botanical gardens and local universities, technical colleges, technikons, schools and support groups. South Africa's National Botanical Gardens have, over the years, developed many innovative environmental education programmes which can be shared with other gardens in the region.

Herbaria and Libraries

Botanical gardens in the region are, for the most part, situated close to herbaria and botanical libraries. Many of the libraries, though, do not keep literature relevant to botanical gardens, such as horticultural literature, and need to be expanded as a matter or urgency. Without herbaria and adequate libraries, it is difficult for staff attached to botanical gardens to conduct meaningful research. Many botanical gardens have herbaria within their boundaries, or adjacent to the garden, such as:

Botswana
- National Botanical Garden (with National Herbarium, GAB)

Malawi
- Zomba National Botanic Garden (adjacent to National Herbarium, MAL)

Mozambique
- INIA Botanic Garden (with LMA Herbarium)
- University Botanical Garden (with LMU Herbarium)

Namibia
- National Botanic Garden (adjacent to National Herbarium, WIND)

South Africa
- Free State National Botanical Garden (has its own herbarium, GOFS)
- Harold Porter National Botanical Garden (has a small herbarium of *ca* 2 000 specimens)
- Karoo Desert National Botanical Garden (has its own herbarium, GKAR)
- Kirstenbosch National Botanical Garden (with Compton Herbarium, NBG & SAM)
- Lowveld National Botanical Garden (has its own herbarium, GLOW)
- Pretoria National Botanical Garden Herbarium (with National Herbarium, PRE)
- Witwatersrand National Botanical Garden (with its own herbarium of *ca* 1 500 specimens)

Zimbabwe
- National Botanic Garden (with National Herbarium, SRGH)

This proximity of herbaria to botanical gardens is useful for research, reference and educational purposes, and closer collaboration between garden and herbarium staff should be encouraged. South Africa's Natal National Botanical Garden is situated in the same town (Pietermaritzburg) as the University of Natal-Pietermaritzburg Herbarium (NU, Smith & Willis 1999a), but is not the optimal arrangement, and certainly not conducive to research that requires access to herbarium specimens and plant taxonomic literature. The same situation applies to the Durban Botanic Gardens, which are in the same city as the Natal Herbarium (NH), which has *ca* 100 000 specimens (Smith & Willis 1999a).

Lesotho's Katse Botanical Garden and the Munda Wanga Trust Botanical Garden in Chilanga, Zambia do not have herbaria either on their property or close by. Efforts should be made to develop herbaria on the properties, including associated plant taxonomic staff, for horticultural research and conservation-related activities. As the Tunduru Botanical Garden in Mozambique is not involved in research, the development of an herbarium on the grounds of the botanical garden is probably unnecessary; there are two functional herbaria already in Maputo, namely LMA and LMU, both of which are linked to botanical gardens.

Infrastructural/Developmental Needs

The following infrastructural and/or developmental needs were noted during the survey.

Botswana

National Botanical Garden

- Develop mission, vision, master plan for the garden.
- Landscaping of various areas of garden, especially to ease the contrast between the landscaped and natural areas of the garden.
- Walking trails on rock outcrops using hiking trail markers (through use of template).

Lesotho

Katse Botanical Garden

- Horticulturist.
- Plant labels.
- Interpretive signage/story boards.
- Plant Records Database.
- Guidance needed with nursery development.
- Terraces to be continued into contours.
- Pines planted as a border along the fence should be removed from the garden. In addition to aesthetic reasons, this invasive alien plant species could also spread to other adjacent areas.
- Indigenous grasses should be grouped in mass displays in clumps (labelled).
- Try not to remove stones from the garden itself in order to prepare paths, as this disturbs the site and facilitates erosion.
- Some paths are on a relatively steep gradient, and should use rocks to prevent erosion.

Malawi

Lilongwe National Botanic Garden

- Need to revise and complete master plan for the garden.
- Need for lawnmower and tractor.
- Need to construct paths and shelters.
- Identification and propagation of threatened plants.
- Interpretive signage required.
- Labelling plants in the garden.
- Develop a living plant collection.
- Need for new offices.
- Botanic garden literature.
- Development of a curation policy.
- Need to decide major plant groups to be planted in the garden.

Mzuzu National Botanic Garden

- Develop a master plan for the garden.
- Employment of one horticulturist.

- Identification and propagation of threatened plants.
- Interpretive signage required.
- Labelling of important plants in the garden.
- Need for new offices.
- Development of a curation policy.
- Need to decide major plant groups to be planted in the garden.

Zomba National Botanic Garden
- Garden needs to be fenced.
- Master plan to be developed.
- Propagation of threatened plants.
- Botanic garden literature.
- Shade house.
- Irrigation.
- Waterpump.
- Develop a plant collections policy.
- Develop living plant collections.
- Need to decide what major plant groups should be planted in the garden.
- Facility to store compost.
- Quarantine area.
- Label machine or labels ordered from the National Botanical Institute.
- Need to give plants accession numbers.
- Computer and database.
- Interpretive signage.
- Stevenson screen for recording weather statistics (should investigate obtaining such a screen from the Malawi Meteorological Services).
- Shed, paths.
- Funds generated go into the general fund of the National Herbarium and Botanic Garden, and not the Zomba National Botanic Garden specifically.
- Remove invasive plants, such as Mauritius thorn, syringa and jacaranda from the garden.
- Document experiments, propagation successes/failures.
- Plants not wanted in the garden should be removed.

Mozambique

INIA Botanical Garden
- Additional borehole on the lower area of the garden.
- Develop a plant record system for the garden.
- Large potting shed could be renovated, break down filled-in parts of walls, fix roof, clean. Basic structure still sound.
- Renovation of greenhouses probably not necessary at present.
- Start with development of arboretum section of garden, labelling of plants (especially trees).
- Inventory plant taxa in garden (preliminary list is available).
- Irrigation system needs upgrading/expanding.
- Develop strategic/master plan for garden; also develop vision and objectives.
- Remove exotics from sections of arboretum.
- Create something in garden that is unique.
- Use of volunteers in managing the garden.

Tunduru Botanical Garden
- Vehicle: tractor.
- Spraying equipment.

University Botanical Garden

- Water tank (not a big problem).
- Accessioning of plants/landscaping.
- Creation of paths.
- Small equipment.
- Lawnmower (diesel-powered).
- Labelling.
- Interpretive signage.
- Special pots for the orchidarium.
- Improvements to the nursery.
- Improvements to the greenhouse.
- Irrigation.

Namibia

National Botanic Garden

- Urgent need to develop master plan for garden.
- Once master plan has been completed, plan collecting trips to develop the various areas of the garden.
- Urgent need for water/irrigation to be provided/installed, possibly using run-off from buildings surrounding the garden.
- Need for interpretive signage and associated equipment.
- Soil depth profiles need to be taken around the garden.
- Temperature profiles needed around the garden.
- Additional horticulturist needed.
- Nursery facilities need attention.

South Africa

Free State National Botanical Garden

- Develop the Plant Records System.
- Plan collecting trips.
- Have plant labels in the garden.
- Establish Visitor Interpretation Centre.
- Herbarium Assistant (on casual basis).
- Upgrade the glasshouse.

Harold Porter National Botanical Garden

- A second horticulturist is required. Extensive collecting, growing and landscaping programmes are required to bring the garden up to standard and these cannot be adequately met by one person.
- An assistant for the chief administrative clerk is required. The administrative load has increased radically. Her job includes typing of all the correspondence, reports and various other documents, stock lists, doing the accounts, petty cash, recording and control of income and expenditure, the banking, reception and telephonist duties, as well as personnel and financial administration. When she is on leave these duties are shared between the curator and horticulturist.
- An interpretive/education officer is required to fulfil the interpretation requirements of the garden (as most of the visitors are adults) and develop and run an education programme for the local schools in the area. This person would also do guide training and coordinate the non-horticultural volunteers.
- The nursery needs to be expanded and upgraded, with at least two more shadehouses and a covered seed sowing area. All the plant bays need to be concreted.

- The irrigation system needs to be completed. This includes a system for the nursery incorporating a good filtration system to cope with the water-borne *Phytophthora* problem.
- The entrance building needs to be completely enclosed to protect visitors and staff from wind and rain.
- The restaurant is now far too small to cope with the volume of visitors and needs to be enlarged (kitchen, storage and seating) to seat at least 60 visitors (one bus load). In time a new building will be necessary to cope with a minimum of 160 guests instead of the 43 who can be seated presently. The present gift shop space is only 9 m^2 and too small. If a new restaurant building should be built, the gift shop could be moved into the present restaurant space.
- A ride-on mower is required to cope with the large lawned areas and save precious man hours required at present to do the mowing with small machines.
- A good quality photocopier is required. The machine now in use gives constant maintenance problems.
- A new Y2K-compliant fax machine is required.
- The parking area needs to be enlarged and the whole area needs to be paved and landscaped to be more visitor-friendly and attractive.
- More directional signage is needed.
- More interpretive storyboards about the flora, fauna and ecology of the area need to be developed and placed in the garden.
- A large number of plant labels are urgently needed.
- As there is no public transport, quarters for horticultural students need to be built near the garden.
- Conservancy tanks need to be built for all the toilets as the garden is in a very high water table area.
- A general storeroom for tools and supplies and a proper workshop for the maintenance of tools, machinery and vehicles is required.
- Office space for additional staff mentioned above is required.

Karoo Desert National Botanical Garden

- Funding is needed for a lath covering to protect the geophyte collection in the Index Nursery from the hot summer sun. These bulbs are a valuable national collection.
- Funding is needed for a covered soil storage area.
- Funding is needed for a laptop computer to aid with accessioning plants in the field. A good second-hand machine would suffice. This laptop would, obviously, have a multitude of other uses.
- A partially covered area for the display of smaller succulents and bulb species. The main reason for this is not only an aesthetic one, but also an educational one.

Kirstenbosch National Botanical Garden

- Need to complete master plan for garden.
- Computerised mapping needs to be completed.
- Functional flow pattern through the garden needs to be established by creating linked routes.
- Urgent need to update plant records database.
- Nursery needs to be reconstructed; process has started.
- Old sections of the garden need to be redeveloped.
- Paving materials need to be standardised.
- Horticultural Hub (Home Gardeners Centre) needs to be developed.
- Additional parking facilities required.
- Replacement of old equipment.
- Living collections need constant re-assessment to ensure they are not stagnating.

- Constant updating required of databases, garden maps, master plan, signage.
- Being an old garden the problem of needing to redevelop areas, in the face of public resistance to change, needs to be sensitively handled.
- Though the garden is large, well developed and has an adequate infrastructure, it is important to remember that a garden is never finished and is in a constant state of flux. To maintain standards, constant inputs and redevelopments are required.

Lowveld National Botanical Garden

- Upgrade parking area (too small).
- Upgrade entrance area to include an interpretation/information area, book shop and plant sales nursery.
- Upgrade of currently dangerous bridge on access road over Crocodile River.
- Lecture room and societies meeting area is needed.
- Educational officer needed to develop and run an environmental education programme.
- An educational centre needs to be developed.
- At least one more horticulturist must be employed.
- One additional vehicle for field work (4x4) needs to be purchased.
- Complete estate (approximately 4 km) needs to be fenced.
- Viewpoint overlooking the Nelspruit Cascades needs upgrading.
- Thatch on building roofs need maintenance.
- Lawnmowers need to be replaced urgently.
- Signage to and in the garden needs to be improved.
- Labels for index plants in the garden are required.
- Two-way radios (6) for communication are urgently needed.
- Invader plants in and surrounding the garden must be controlled.
- Collecting trips to southern African rain forest areas must be undertaken so as to complete development of the African Rain Forest area—the area is currently stagnating due to a shortage of plant material.
- Current plans to develop the northern bank of the Crocodile River will lead to a further demand for staffing and equipment: at least one more horticulturist and five labourers will have to be employed.

Natal National Botanical Garden

- Education staff are needed.
- Entrance building and gift shop are needed.

Pretoria National Botanical Garden

New facilities:

- Parking facility for 250 cars and five buses.
- Entrance building: public access control to both garden and National Herbarium Lecture Hall and display facilities; information centre; book/curio shop; Garden Sales Centre; public toilets; garden administration offices.
- New staff facilities: change rooms for garden-based staff.
- Garages and stores: new facilities for garden vehicles and equipment.
- Environmental Education Centre: Lecture and display facilities; Offices; Library; Store rooms.
- Garden perimeter fencing: 3.5 km of steel/concrete palisade fencing.
- Display glasshouse: Succulent collection; Desmond Cole Lithops Collection; Madagascan flora, African epiphytic orchids.
- Restaurant: Open for evening functions, accessible from parking area.
- New staff house: Replace existing house (No.3); renovation will be too expensive.

Existing infrastructure:

- Upgrade road: Service road between nursery and garden—use existing paving bricks to complete ring road near bird sanctuary and other internal garden paths.

- Nursery production houses (5): New fibre-glass sheeting.
- Glasshouse structures (3): Renovate glazing and electrical systems.
- Velcich House: Convert outside rooms into a flatlet for security purposes.
- Irrigation system: New ring supply for both nursery and garden.
- Cover existing four reservoirs.
- Workshop and stores: Renovate existing facilities.

Vehicle/equipment replacement:
- New tractor: Massey Ferguson 240/equivalent; New tip trailer for tractor.
- New tractor: Smaller tractor for lawn-mowing purposes.
- New 3.5 ton truck, used for refuse removal and sundry materials transport.
- Mowers and sundry: Large turf mower; rough grass cutter; chipper; concrete mixer.

Staff Requirements:
- Training and Safety Officer: Staff Training and Development Coordinator; OHASA matters; Skills Development Act applications.
- Garden Information Officer: Guided tours; Volunteer Guide programme and training; Garden information services; Function/Activity Coordinator e.g. concerts.
- Outreach horticulturist: Community-based outreach programmes; liaison between garden and education-based activities.
- General Workers: Filling of eight labourer vacancies.

Garden Development Projects:
- Complete bird sanctuary area.
- Northern garden arboretum area.
- Display gardens: botanical terminology; handicapped gardening; geology; evolutionary; fragrance; early settlers plant uses; summer rainfall Proteaceae.
- Renovate and upgrade water features.
- Renovate *Aloe* display.
- Renovate *Euphorbia* display.

Witwatersrand National Botanical Garden

New facilities:
- Garden Centre, shop, redevelopment of entrance and visitor facilities.
- New restaurant.
- Conservatory/glass house.
- Soil mixing and storage areas.
- Potting shed in index nursery.
- Propagation beds in index nursery.
- Poison store.
- Office for education staff.

Upgrading/replacement of existing facilities:
- Repair and recladding of motor bridge.
- Development of overflow parking area.
- Upgrade service roads.
- Surfacing of roads in index nursery.
- Surfacing of work area and yard at stores.

Replacement of movable capital equipment:
- 4x4 vehicle for field work and estate management.
- Two Massey Ferguson 240 tractors or equivalent.
- Bus for outreach education work.

New Garden Development:
- Development of magico-medicinal garden and fragrance garden.
- Redevelopment of succulent garden.
- Reconstruction of water garden.
- Geological garden development.

- Turf grass demonstration garden.
- Frost demonstration garden.
- Sasol Dam marsh extension, drainage and repairs.
- Development of a demonstration food garden at education centre.
- Potting facilities at education centre.

Estate:
- Fencing.
- Alien control.
- Erosion control.

Human Resources:
- Additional horticulturist/botanist post.
- Full-time education administrative assistant.
- Outreach education officer.
- Groundsmen posts—currently seven are vacant yet unfilled.

Information:
- Complete computerisation of garden records.
- Labelling of plants in garden.

Zambia

Munda Wanga Trust Botanical Garden
- Visitor centre needed.
- Nurseries required.
- Fenced boundary.
- Interpretive signage.
- Plant labels.
- Nursery/propagation area needs to be developed and improved.
- Auditorium.
- Exhibition area.
- Bookshop.
- Arboretum.
- Lawnmowers.
- Irrigation.
- Computerisation of collections.

Zimbabwe

National Botanic Garden

Equipment:
- Tractor (240 Massey Ferguson, 80 hp) and tip trailer.
- Propagation house.
- 25-seater minibus (transport for staff to and from the city).
- Poison storeroom.
- Fuel storeroom.
- Fertilizer storeroom.
- Additional boreholes (alternatively, deepening of existing boreholes).
- Subsoiler.
- Chipper.
- 80 sprinklers.
- Motorbikes/bicycles.
- Eight two-way radios.
- Two base stations in Harare and Mazoe.
- One-man rowing boat.
- Slasher/rotary mower for tractor.

Staffing:
- Eleven existing posts (currently frozen).

General:
- Soil sterilisation.
- Master/strategic plan.
- Map showing the irrigation network of the garden.

Summary

- Administrative staff
- Bookshop
- Boreholes
- Botanical literature
- Computer(s)
- Conservatory/Glasshouse
- Directional signage
- Education Centre
- Erosion control
- Fax machine
- Fencing of garden
- Fertilizer storeroom
- Fuel storeroom
- Garden Centre
- Gardens mapped
- Greenhouse development
- Horticulturists
- Index nursery maintenance and development
- Interpretive Officer/Education Officer
- Interpretive signage and story boards
- Irrigation systems installed/upgraded/expanded
- Lawnmowers
- Nursery development
- Office space
- Parking area
- Part-time herbarium assistant
- Photocopier
- Plant labels
- Plant records database and accessioning
- Poison storeroom
- Quarantine area
- Radios (2-way)
- Removal of alien invasive plants
- Restaurant
- Spraying equipment
- Storage for growing media, soil, sand, compost, etc.
- Storeroom for tools and supplies
- Theme gardens
- Tractor and trailer
- Upgrading/replacement of old equipment
- Vehicle(s)
- Visitor Interpretation Centre
- Workshop (for maintenance of vehicles and equipment)

Training needs

The following training needs were expressed by the various botanical gardens during the survey:

Botswana

National Botanical Garden

- Basic training in garden management for labour staff.
- Training from gardener level to MSc Level.
- Knowledge of EIAs.
- Botanical Latin.
- Propagation and cultivation of indigenous plants.
- Short-term attachments of staff to other botanical gardens in the region with similar vegetation (and from NBI Gardens to Gaborone).
- Chain saw operation, use of brush cutters.
- Landscape design.
- Field collecting techniques.
- Research techniques.
- Compost area preparation.
- Lawnmower maintenance.
- Use of chemicals.
- Environmental education.
- Interpretive signage, labelling of plants.
- Irrigation system installation and maintenance.
- Local training to identify plants.

Lesotho

Katse Botanical Garden

- Plant Records Database.
- Guidance needed with nursery development.

Malawi

Lilongwe National Botanic Garden

- BSc in Horticulture.
- Staff exchange or attachments.
- Practical garden management (hands on training).
- Landscape design of botanic gardens.
- Environmental Education Programmes.
- Propagation techniques (seeds, grafting, budding and others).
- Irrigation techniques.
- Use of computers/databases in botanic garden management.

Mzuzu National Botanic Garden

- Staff exchange or attachments.
- Practical garden management (hands-on training).
- Diploma in Horticulture.
- Environmental Education Programmes.
- Propagation techniques (seeds, grafting, budding and others).
- Botanic Garden Management.

Zomba National Botanic Garden

- Horticulture at MSc level.
- Staff exchanges/attachments.
- Practical garden management (hands-on training).

- Landscape design of botanic gardens.
- Financial management/budget control.
- Propagation techniques (seeds, grafting, budding, and others).
- Irrigation techniques.
- Use of computers/databases in botanic garden management.

Mozambique

INIA Botanical Garden

- MSc course in plant horticulture.
- Short course training in garden management.
- Short course training in plant conservation techniques.
- Short-term training in plant propagation and multiplication.
- Environmental education in botanic gardens.
- Landscape architecture.
- Labelling.
- Plant record system.

Tunduru Botanical Garden

- Staff training in horticulture, garden management, plant records/computerisation (currently no computers in garden).

University Botanical Garden

- Horticultural training.
- Accessioning of plants/landscaping.
- Labelling.
- Interpretive signage.
- Environmental education training.
- Garden management.
- Plant records databasing.

Namibia

National Botanic Garden

- Management of a botanic garden.
- Computerisation of collections.
- Record keeping of plants.
- Collecting techniques.

South Africa

Harold Porter National Botanical Garden

- Better basic horticultural training for two nursery staff.
- A more intense social upliftment programme for 15 of the staff members that will help to instil a better work ethic and values.
- A job-related Customer Service training programme.
- A Human Resource Management programme is also required.

Karoo Desert National Botanical Garden

- Funding should be made available for the training of student horticulturists. This is for their six-month practical.

Zambia

Munda Wanga Trust Botanical Garden

- Botanical garden management.
- Propagation methods.

- Plant identification.
- Propagation methods.
- Landscaping.
- Nursery management.
- Plant records.
- Pest control.
- Irrigation.
- Labelling/interpretational signage.
- Basic knowledge of mechanics of equipment and equipment maintenance.

Zimbabwe

National Botanic Garden

- Course(s) on staff supervision.
- Computerisation.
- Labelling.
- Plant recording.
- Arboriculture.
- Attachment to other southern African botanical gardens.
- Botanic Garden Management.
- Health and Safety courses.
- Nursery management.
- Landscape design.
- Machinery maintenance.
- Upgrading of horticulturists to degrees.
- Commercial horticulture.

Recommendations

It is important that southern Africa's botanical gardens develop their visions, missions and master plans in order to guide their development. Gardens need to consider their development within a local context, and not try to emulate other gardens in the region or in other parts of the world. Support must be obtained from the local surrounding community, and the garden should be seen as an essential part of community life. It is only through soliciting support from the local community that the gardens surveyed will have any chance of sustainability. Gardens must also demonstrate their relevance to the conservation and sustainable use of botanical diversity in the area and country. Linkages also need to be developed with national and provincial conservation agencies responsible for environmental management, and staff attached to gardens need to become involved in national planning exercises and contribute to national and local conservation projects. Botanical gardens as collections of living plants must be justified from every possible point of view "in order to be able to continue to assert their right to support" (Raven 1981).

Most of the staff training needs of the various southern African botanical gardens could be addressed in tailor-made training courses hosted by the National Botanical Institute in South Africa. Components of this course, or a separate course, could be presented on the development of master plans and also the computerisation of collections. The NBI's Data Management section has recently developed an in-house PRECIS Garden Records Database (developed using Microsoft Access), which is currently being used by several of South Africa's National Botanical Gardens to computerise their collections, and could be adopted by gardens elsewhere in southern Africa.

Other training needs, although not specifically mentioned by the gardens surveyed, might include workshops on the role of gardens with relation to both the Convention on Biological Diversity

(CBD) and the operation and implications of other important conventions, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the United Nations Convention to Combat Desertification (CCD), the United Nations Framework Convention on Climate Change (UNFCCC), Agenda 21 (concerning sustainable development in the 21st century) and the Convention on Wetlands (Ramsar). Peter Wyse Jackson (1997) has written a very useful article on the impact of the CBD on botanical gardens, as well as producing a basic checklist for botanical gardens to guide their involvement in implementing the CBD. This has been supplemented by articles by Peter Wyse Jackson, Etelka Leadley and Christopher Hobson (1999) in the June 1999 edition of *Botanic Gardens Conservation News*. The BGCI's publication *A CITES manual for botanic gardens* (Akeroyd *et al.* 1994) is also an essential document guiding gardens in their implementation of CITES. Other useful publications produced by Botanic Gardens Conservation International (BGCI) include *The Botanic Gardens Conservation Strategy* (IUCN-BGCS & WWF 1989), *Handbook for botanic gardens on the reintroduction of plants to the wild* (Akeroyd & Wyse Jackson 1995), *Botanic Gardens Conservation News* and the forthcoming *Handbook on plant conservation in botanic gardens* (in prep.). Closer links need to be developed between SABONET, the BGCI, Royal Botanic Gardens Kew, and other botanical garden networks and capacity-building programmes around the world. An MoU between SABONET and the Australian Network for Plant Conservation (ANPC) has recently been endorsed by the respective governing bodies. The project's newsletter, *SABONET News*, and the occasional *SABONET Report Series* can serve as useful vehicles for sharing relevant information amongst botanical gardens in the region as they are currently doing for staff attached to southern African herbaria.

Box 3. Garden Records Database System

by Trevor H. Arnold, National Botanical Institute, Private Bag X101, Pretoria 0001, South Africa

This system is designed as a management tool for garden curators. It allows detailed information to be stored about plant material accessioned into botanic gardens, recording the location and subsequent movement of the material within the garden. It allows for the condition and extent of survival of material to be monitored through time. Reporting facilities include accession details, the location of material within the garden and lineage reports outlining the movement of collections through time.

The Garden Records Database system is a component of PRECIS (National Herbarium, Pretoria (PRE), Computerized Information System). PRECIS's origin dates back to 1972 when a decision was taken to computerize the collections of the National Herbarium. For most of its existence PRECIS has focused on specimen-based information and was limited in its use to the National Herbarium. More recently the need to expand this focus to include taxon-based information was realized. At the same time there arose a need to make PRECIS available at the PC level to other NBI herbaria as well as to many non-NBI herbaria. The first development of PRECIS for the PC focused on the Specimen component. This was followed by the development of various other components, the most recent being the Garden Records component, which is currently installed at most of the botanical gardens of the NBI.

The Garden Records system consists of two distinct databases, the first stores the garden records information and the second the plant names. This multiple database design is used for all PRECIS PC-based systems. The database was developed from the Specimen PC database and for the most part is an exact replica of it. Both these databases focus on information about plants accessioned largely from the wild. In the Garden Records system this has been extended to allow for the monitoring of the storage and planting of living collections in the garden.

Each record in the database is identified by a unique string comprising the garden name (code), the year of accession and an accession number. Detailed information about each accession includes the collector's name and collection number, date of collection, plant name, and if the material was donated, information about the donor.

Information about the collection site includes the region, precise locality, spatial reference point (quarter degree grid and degrees, minutes and seconds), habitat (macro and micro, e.g., mountain slope, seepage area), aspect and altitude. Other habitat information includes substrate, soil type, geology, vegetation type and exposure, as well as local abundance and biotic effect (e.g., habitat disturbance). Information about the plant includes plant height, growth form, presence of flowers, fruits and seeds, flower colour and the type (bulb, seed, cuttings etc.) and amount of material collected. Provision is also made for recording whether herbarium vouchers were prepared or photographs taken, as well as the distribution of duplicate material to other gardens and individuals.

Once accessioned, a record can then be kept of the location of the material within the garden. This is done at various levels from a primary location (i.e. seed store, nursery, garden) to detailed location (i.e. shelf, table or bed number). The system also provides for a log to be kept of the movement of the material within the garden through time. The continued survival of the material can also be logged including information on the state and number of individuals living and if dead the cause of death.

Reporting options include printing accession details based on accession number, taxon (family, genus, species) or collector, as well as various reports on the current location of material in the garden down to the bed level and a historical record (lineage) of the subsequent collection and replanting of material taken from the original or subsequent plantings.

The PRECIS Garden Records Database system currently runs in Microsoft Access 2. Towards the end of 2000 it is to be upgraded to run in Microsoft Access 97/2000 with a Delphi front-end. Storing the data in Microsoft Access allows users the opportunity to develop their own queries and report routines. The minimum hardware requirement is a Pentium II, 300 MHz processor with 30 MB RAM and 500 MB disk space (for Microsoft Access software and database).

With reduced membership fees now available for botanical gardens in developing countries, each of southern Africa's botanical gardens should be encouraged to become a member of the BGCI. According to the BGCI's membership directory for 1999 (Holland 1999), national botanical gardens in only *two* of the southern African countries surveyed (Malawi and South Africa), are currently members of the BGCI. Being members of the BGCI will allow staff in each of southern Africa's botanical gardens to receive BGCI's regular publications (*Botanic Gardens Conservation News* and the environmental education newsletter, *Roots*) as well as a wide range of other technical publications, and allow staff to be kept informed of recent developments in, and share experiences and information with, botanical gardens from around the world. It will also illustrate commitment on the part of the staff attached to the botanical gardens to be part of the global network for botanical gardens and plant conservation.

The following general recommendations, several of which are closely aligned with the BGCI's *International Agenda for Botanic Gardens in Conservation* (Wyse Jackson & Sutherland 2000), can be made with regard to the development of southern Africa's botanical gardens:

Inventory/Garden Records

- Computerisation of living collections should be seen as a priority, and computerised information should be backed up regularly.
- Good records should be kept of plants growing in the garden.
- Prepare checklists of the non-landscaped areas of the garden (which should involve integration with herbaria and associated staff).
- Maintain an up-to-date inventory of plants in the garden.
- Ensure that the botanical garden collections, data and expertise are made available and utilised to the fullest extent possible.

Funding

- Gardens need to source locally/nationally for additional funding and infrastructural support; where available, this can be supplemented by international funding.
- Solicit private sponsorship when government funding is meagre or non-existent.

Collaboration

- Closer collaboration with conservation agencies should be encouraged, specifically with regard to the propagation, cultivation, reintroduction and subsequent monitoring of threatened plants, as well as in the preparation and implementation of species recovery plans and programmes.
- Network with other gardens to share resources and knowledge.
- Carefully planned and considered short-term (up to 3 months) attachments or fellowships should be developed between gardens within the region.
- Communication between the region's garden staff should be enhanced, particularly through the medium of electronic mail.
- Collaborate and develop partnerships with other African botanical gardens and gardens with similar climates and vegetation types (e.g., Katse Botanical Garden with other alpine botanic gardens around the world).
- Establish collaborations with development agencies that work to integrate biodiversity conservation with sustainable use of plant genetic resources.

Conservation

- Integrate *ex situ* activities and *in situ* plant conservation through botanical gardens.
- Promote public awareness of the importance of *in situ* conservation and need for integrating *in situ* and *ex situ* conservation activities.
- *Ex situ* conservation should be seen *as a means to an end*, not an end in itself.
- Become relevant to the surrounding community in an integrated way, without losing sight of the fact that the primary focus of botanical gardens should be on the conservation and sustainable use of plants; use every opportunity of visitors visiting the garden to promote the conservation of plants.
- Endemic, rare/threatened, 'flagship' species (which stimulate conservation awareness) and economically-important plants should receive priority for inclusion in *ex situ* collections.
- Identify priority tasks, institutional responsibilities and resources that will be available to support specific conservation programmes.
- Become involved in national planning processes, such as in the preparation and implementation of National Biodiversity Strategies and Action Plans (NBSAPs).
- The Convention on Biological Diversity (CBD) should guide the operation of the botanical garden.
- Develop policies, procedures and practices based on the recommendations of the CBD.
- Ensure all staff are aware of and follow the garden's policies, procedures and practices relating to implementing the CBD based on the recommendations of the CBD; publicise the CBD and its objectives to garden visitors and supporters.

- Support and contribute to the implementation, where possible, of the following conventions apart from the CBD: Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention to Combat Desertification (CCD), United Nations Framework Convention on Climate Change (UNFCCC), World Heritage Convention, Convention on Wetlands (RAMSAR).
- Botanic gardens must prove their relevance to the conservation of natural and cultural heritage and their importance as national institutions for science, culture, recreation and tourism.
- Adopt and implement, where possible, the new *International Agenda for Botanic Gardens in Conservation*.
- Become involved in the monitoring and identification of plant diversity at all levels.

Education/Training

- Support and empower staff through relevant training, skills and knowledge development.
- Where possible, use the skills within the garden to provide courses that build the capacity of the general public.
- Botanic gardens should be developed as centres for environmental education and sustainability by having well planned environmental education programmes *with appropriate resources allocated*.
- Develop an environmental education strategy identifying and prioritising the target groups, conservation messages, sustainability and development issues to be addressed.
- Education programmes should incorporate a vision for a more socially and environmentally sustainable future.
- The design and implementation of a mentorship programme should be considered for botanical garden managers and horticulturists.
- Develop interpretive and directional signage appropriate to the surrounding community.
- Relate the role of environmental education to demographics in southern Africa, e.g. number of children/proportion of population below a certain age.
- Demonstrate the interdependence and relationship of society and nature.

Management

- Work with staff in developing and documenting practical and realistic strategic plans, institutional policies and business plans, and put in place mechanisms for their implementation.
- Involve staff in all levels of planning and decision making.
- Develop relationships with expert support teams to assist in botanical garden development.
- Modern, high-technology equipment is not necessary for a garden to be effective. Gardens can do a lot with a little. Consideration of the questions "how/what/why" are important.
- Gardens need to concentrate on getting the basics right.
- Develop a management plan for the natural area of the garden.
- Encourage the involvement of volunteers in the management of the botanical garden and the establishment of a "Friends" of the garden.
- Manage collections according to strict scientific and horticultural standards.
- Actively remove exotic and alien invasive plant species from the natural areas of the garden.
- Update and re-evaluate collection, conservation, research, labelling, education and other policies on a regular basis to ensure that they remain relevant to the changing needs of the organisation and national and international policies.
- Promote occupational Health and Safety within the botanical garden.

Marketing

- Promote the garden so as to attract tourists, and work with local, national and international tourist authorities to seek their advice and assistance in publicising the botanical garden.
- Promote sustainable tourism, and all appropriate activities that are associated with it.

Botanical Garden Management Course

Regarding the training needs amongst botanical garden staff within the southern African region, a tailor-made course should include most, if not all, of the subject areas listed below.

Proposed course modules are

- Development of vision, mission and master plans
- Development and implementation of business plans
- Fundraising
- Propagation and cultivation techniques
- Landscape design
- Environmental education
- Interpretive signage and labelling
- Irrigation techniques
- Use of chemicals
- Use of chain saws, brushcutters
- Nursery development and management
- Garden Records Database
- Financial Management and budget control
- Fund-raising
- Plant Record System
- Preparation of compost areas
- Field collecting techniques
- Research techniques
- Customer service
- Pest control
- Human resource management/staff supervision
- Equipment/machinery operation and maintenance
- Arboriculture
- Health and Safety
- Commercial horticulture
- Integration of *ex situ* and *in situ* conservation
- Development of living collections policy

Some of these may need to be held as stand-alone courses, for example:

- Environmental education
- Garden Records Database
- Human Resource Management

Networking Southern African Botanical Gardens: The Way Forward

The concept of a network of botanic gardens is simultaneously simple in concept yet difficult in practice. Networks can take various forms: all members can be of equal status or there can be a central core consisting of a few or even a single garden (Heywood 1990). The details of a southern African botanical garden network must still be decided by the participating institutions; it is envisaged that this network could operate through the existing Southern African Botanical Diversity Network. According to Heywood (1990) the key to a network is the willingness to cooperate in implementing a common set of objectives. From our preliminary discussions, it does appear that the southern African botanical gardens whose institutions are participating in SABONET are very willing to cooperate in establishing a network of botanical gardens. We suggest that representatives from the relevant gardens should come together, probably at a regional workshop, to discuss how they are to take the networking process further and to develop an action plan. SABONET, as a capacity-building programme, does have funds available

within the GEF/UNDP budget to host such a workshop and develop tailor-made training courses for horticulturists in the regional botanical gardens, but there are no funds within the current budget to support infrastructural development within the region's botanical gardens.

Box 4. Twinning Southern Africa's Botanical Gardens

Heywood (1990) has stated that "the main areas of interest to be covered by networks are probably *ex situ* conservation in gardens, whether of living material or of seeds, and training and education, involving so called 'twinning' arrangements with other gardens outside the area". The concept of "twinning" botanical gardens is one which has already been identified by the National Botanical Institute as a way of expanding the already existing South African national botanical garden network of eight gardens to a ten-country regional network of southern African botanical gardens. It is envisaged that each of the National Botanical Institute's (NBI) gardens, excluding the Harold Porter National Botanical Garden at Betty's Bay will be involved in the twinning exercise. Davies & Ndam (1997) have described the network of NBI's eight botanical gardens existing in South Africa as "the most advanced gardens of Africa". This does not imply that they are any better than other gardens in the region, but have consistently been supported by government in terms of funding and have, over the years, developed a core group of experienced professional horticulturists and other staff working in the gardens. These staff are very capable of offering training courses to botanical garden staff in other southern African gardens and willing to share their expertise and experience developed over many years.

The proposed arrangement for the twinning of southern Africa's botanical gardens is as follows:

- ANGOLA—Currently no botanical garden
- National Botanic Garden, BOTSWANA—Kirstenbosch National Botanical Garden, South Africa
- Katse Botanic Garden, LESOTHO—Free State National Botanical Garden, South Africa
- Lilongwe National Botanic Garden, MALAWI—Twinned garden to be determined
- Mzuzu National Botanic Garden, MALAWI—Twinned garden to be determined
- Zomba National Botanic Garden, MALAWI—Pretoria National Botanical Garden, South Africa
- LMU Botanic Garden, MOZAMBIQUE—Lowveld National Botanical Garden, South Africa
- National Botanic Garden, NAMIBIA—Karoo Desert National Botanical Garden, South Africa
- SWAZILAND—Currently no botanical garden. Should one be developed, it will 'twin' with Natal National Botanical Garden, South Africa
- Munda Wanga Trust Botanical Garden, ZAMBIA—Twinned garden to be determined
- National Botanic Garden, ZIMBABWE—Witwatersrand National Botanical Garden, South Africa

The idea of twinning the gardens will have to be discussed in more detail by staff of the institutions and countries concerned and by the SABONET Steering Committee for its approval, but could involve short-term exchange of staff between the 'twinned' gardens and the sharing of ideas, expertise and experience between staff attached to the gardens as well as beneficial joint initiatives. These might include undertaking research on specific plant taxa; for example, collaborative research between Namibia's National Botanic Garden and South Africa's Karoo Desert National Botanical Garden in the propagation and re-introduction of *Aloe pillansii*, which is listed on CITES Appendix I (Akeroyd, McGough & Wyse Jackson 1994) and has been classified as Endangered (A1acde, B1+2be)(Hilton-Taylor 1996; Walter & Gillett

1998; Smith, Steyn, Victor, Crouch & Golding in press) and is found in both South Africa and Namibia. This would also necessitate the involvement of herbaria, universities and national and provincial conservation agencies in the respective countries, and help to promote collaboration between the gardens and these institutions. Botanical gardens in Malawi and Zimbabwe are both well positioned to develop similar rare plant programmes in the respective countries. Botanical gardens in general have been recognised worldwide as being important agents in a multifaceted effort to conserve rare and endangered plant taxa (Elias 1987).

The twinning exercise will also help to address Article 17 of the Convention on Biological Diversity (CBD) which states that "*1. Contracting Parties shall facilitate the exchange of information....taking into account the special needs of developing countries; 2. Such exchange of information shall include exchange of results of technical, scientific....research, as well as information on training and surveying programmes, specialized knowledge, indigenous and traditional knowledge as such and in combination with the technologies referred to in Article 16, paragraph 1*" (which refers to *Access to and Transfer of Technology*). The information to be exchanged is not limited to that from developed countries. All countries have potentially useful information relevant to the conservation and sustainable use of biological resources. Therefore, all Contracting Parties are expected to exchange such information with other Parties (Glowka, Burhenne-Guilmin & Synge 1994; Synge 1996).

A one-to-one relationship is not necessarily the most effective one, however, and various forms of linkages should be explored. The benefit of such a regional network is that there are several other gardens available within the network to consult with, depending on the circumstances, and 'twinned' gardens are not restricted to dealings with each other. There is probably also a need to expand the network of gardens to beyond those participating officially in the SABONET project. This might have great potential benefits to both the *ex situ* and *in situ* conservation of southern Africa's botanical diversity. For example, a collaborative research project could be conducted on cycads by staff attached to South Africa's Lowveld National Botanical Garden, Kirstenbosch National Botanical Garden, Pretoria National Botanical Garden, Witwatersrand National Botanical Garden as well as Zimbabwe's Vumba Botanical Garden (Murimba 1997) and Ewanrrig Botanical Gardens, all of which have comprehensive collections of cycads (Rycroft 1983; Osborne 1990,1995). Expansion of the stocks of cycads in these gardens should be made from the numbers of plants confiscated from illegal trafficking operations (Osborne 1990).

Integrating *Ex Situ* and *In Situ* Plant Conservation

Ex situ and *in situ* plant conservation strategies should be seen as complementary to one another, each having as its objective the maintenance of plant genetic diversity (Bedini 1997; Benson 1997; Hamann 1997; Maxted *et al.* 1997; Offord & Tyler 1997; Pushpangadan & Nayar 1997). In this "holistic" approach, one conservation strategy or technique will act as a back-up to another, the degree of emphasis placed on each depending on the resources available, the aims and the utilisation potential for that target taxon (Maxted *et al.* 1997). Few of southern Africa's national botanical gardens have well-structured, functional threatened plant programmes, and there are relatively few documented cases of southern African botanical gardens integrating with *in situ* conservation programmes (for examples, see Burke 1999, 2000). Despite this, more than 300 threatened or critically rare species are represented in southern African botanical gardens, often by very small populations (Hall *et al.* 1984). One well-documented example is the involvement of Kirstenbosch National Botanical Garden's Endangered Plant Lab in the cultivation of, and research on, one of South Africa's rarest shrubs, *Raspalia trigyna* (Bruniaceae). This is the only member of the family to grow outside the winter rainfall area of the Cape

Floristic Region (CFR); the only known existing population of *R. trigyna* left in the wild comprises a few individuals (Abbott 1988a,b; Arkell 1995, 1996a,b). The horticultural staff of the Lowveld and Pretoria National Botanical Gardens have also played an important role in propagating and cultivating the threatened Soutpansberg endemic *Stapelia clavicorona* (Asclepiadaceae) for reintroduction to the wild. Other examples of southern African botanical gardens integrating with *in situ* conservation programmes are described in Hall and Veldhuis (1985).

As described by Hall (1983), a common but misleading belief is that a permanent solution can be sought by holding small samples of natural populations in horticulture. The chief role of horticulture for threatened species should be to provide a *temporary home* for raising large numbers of individuals for use in *restoring natural populations* in the wild (Hall & Rycroft 1979; Hall 1983; Hall & Ashton 1983). Because of the pitfalls associated with reintroduction (*sensu lato*) programmes, the need for serious scientific justification and basis for each reintroduction is obvious and supervision and monitoring by qualified scientists is essential (Bramwell 1991; Akeroyd & Wyse Jackson 1995). The documentation and reporting of results is also essential, as information about failures is as important as the reporting of successes (Bramwell 1991). As is probably the case in many other regions of the world, considerable empirical information exists in conservation agency and other files; however, these data are often uncompiled or analysed, and access to them is difficult. Another universal problem is that many reintroductions have been done opportunistically, and have not benefited by strategic planning, biological evaluation or monitoring (Falk, Millar & Olwell 1996).

Box 5. *In Situ* Plant Conservation Activities

Selected examples of southern African botanical gardens' involvement with *in situ* plant conservation activities, either through rescue, propagation/cultivation or reintroduction.

TAXA	*REFERENCES*
Aloe peglerae	Pfab (1988); Sharon Turner (pers. comm.)
Aloe suzannae	Smith & Swartz (1997, 1999); Swartz (1997)
Dracophilus delaetianus	Burke (1999)
Euphorbia melanohydrata	Burke (1999)
Freylinia visseri	Van Jaarsveld & Duncan (1983)
Frithia pulchra	Swartz (1996)
Gasteria baylissiana	Van Jaarsveld (1991, 1994, 1999)
Lachenalia mathewsii	Duncan (1986)
Lithops lesliei	Swartz (1996)
Raspalia trigyna	Abbott (1988a,b); Arkell (1995, 1996a,b)
Saphesia flaccida	Rowley (1991); van Jaarsveld (1994)
Sarcocaulon spp.	Burke (1999)
Stangeria eriopus	Crouch, Symmonds, Smith, Dalzell, Donaldson & Scott-Shaw (in prep.)

As has been suggested by Akeroyd & Wyse Jackson (1995), a "priority of networking might be a readily available and accessible database of reintroduction examples including electronic linkages between institutions with literature references where appropriate, and a similar database of practical aspects of reintroduction, especially techniques of horticulture, aftercare and management."

Box 6. Conservation of *Aloe peglerae*

Aloe peglerae. *(Photo: G.W. Reynolds)*

Horticultural staff attached to the Witwatersrand National Botanical Garden (WNBG), South Africa, are currently collaborating on a project with staff of the provincial conservation agency, Gauteng Nature Conservation, concerning the threatened succulent, *Aloe peglerae* (Pfab 1988). Known only from two provinces in South Africa, *Aloe peglerae* has been assessed as Endangered (A1acde, B1+2bce) using the new IUCN Red Data categories (Smith *et al.* in press).

The project involves (a) regular monitoring of several *A. peglerae* sub-populations, (b) establishment of an *ex situ* population of *A. peglerae* at WNBG which can function as both a seed orchard for providing seed to the horticultural industry and as a reserve of genetic material for possible future re-establishment in the wild, and (c) germination trials with seed from different localities (Sharon Turner, pers. comm.).

Box 7. *Euphorbia* Described As New Species After 22 Years In Cultivation

The importance of close collaboration between horticulturists and plant taxonomists is illustrated by the case of *Euphorbia leistneri* (Archer 1998). *E. leistneri* (Euphorbiaceae), a succulent shrub growing in the collection of the Pretoria National Botanical Garden, was described as new to science in 1998 by Robert Archer, a plant taxonomist in South Africa's National Herbarium (Archer 1998). This species was first collected in 1976 by Leistner, Oliver, Vorster and Steenkamp near the Epupa Falls in northern Kaokoveld, Namibia, and was mistaken in the Pretoria National Botanical Garden for *E. monteiri*, to which it looks superficially similar. In addition to its being described as a new species after 22 years in cultivation, *E. leistneri* has also been described as critically rare, known only from one locality near Epupa Falls in northern Namibia.

Euphorbia leistneri. *(Photo: Adela Romanowski)*

Box 8. Reintroduction of the Endangered Stapeliad *Stapelia clavicorona* I. Verd. In the Soutpansberg

by Johan Hurter, Lowveld National Botanical Garden, P.O. Box 1024, Nelspruit 1200, South Africa

Stapelia clavicorona *in habitat in the Soutpansberg. (Photo: Christopher Willis)*

Stapelia clavicorona (Asclepidaceae) is a rare plant only known from a few localities in the Soutpansberg area of South Africa. Highly sought after by collectors, it was at one stage known from less than three plants in the wild. The Lowveld National Botanical Garden in conjunction with the then Flora Section of the Transvaal Nature Conservation Services (TNC), set out on a programme to investigate suitable hand pollination and cultivation methods for this endangered taxon in 1992. Plants were obtained from the TNC for the project. Hand pollination and germination was easily manipulated in a secure area and resulted in several hundred plants in 1993. These plants were grown to flowering size so as to establish that no hybridization was involved. The project culminated with the handing over of *ca* 100 plants to the TNC for reintroduction.

Young plants of Stapelia clavicorona *securely packed for their 400 km journey to the reintroduction site. (Photo: Johan Hurter)*

Mr Peter Ngwenya assists Mr A. Lindstrom of the TNC in loading the first group of Stapelia clavicorona *for reintroduction. (Photo: Johan Hurter)*

Box 9. *In Situ* Pollination of the Endangered Cycads *Encephalartos heenanii, E. dyerianus* and *E. middelburgensis*

by Johan Hurter, Lowveld National Botanical Garden, P.O. Box 1024, Nelspruit 1200, South Africa

Encephalartos heenanii and *E. dyerianus* are two very rare and endangered cycad taxa from South Africa. *E. heenanii* has been severely impacted by afforestation, collector pressure, inbreeding with its sympatric neighbour (*E. paucidentatus*) and poor land use practices. Natural pollination yields no viable progeny and the taxon

appears to be functionally extinct. The Lowveld National Botanical Garden's expertise had on several occasions been requested by the then Ka-Ngwane Parks Corporation and presently the Mpumalanga Parks Board to assist with the *in situ* hand pollination of receptive female cones. This project is current and members of the Mpumalanga Parks Board have now been trained in hand pollinating the female cones of *E. heenanii*, which are difficult to pollinate due to their structure.

Harvesting male cones of Encephalartos dyerianus *in the Lilie Flora Reserve. (Photo: Johan Hurter)*

Encephalartos dyerianus is an extremely rare cycad, confined to a single hill in the arid Lowveld Bushveld. Harsh climatic conditions and near absence of natural pollinators have led to a very poor age class structure in the colony. Seedling mortality rate in the years of establishment is extremely high. During the course of 1992 staff members of the Lowveld National Botanical Garden artificially pollinated the whole colony in what was a mast year. Five percent of the seed was harvested and germinated at the garden, resulting in several hundred seedlings which was used in the establishment of an *ex situ* conservation area in the garden. Resultant mortality in the wild locality has left less than five seedlings from thousands of seeds produced that year.

During the same year a similar project was launched on the endangered *E. middelburgensis*. Several hundred seedlings were produced and are being grown to a bigger size at the garden. These seedlings will be used in both an *in situ* and *ex situ* conservation project. After establishing approximately 100 plants in a gene bank in the garden, the remainder of the plants will be allocated for reintroduction to the wild by the Mpumalanga Parks Board.

Pollinating receptive female cones of Encephalartos dyerianus *in the Lilie Flora Reserve. (Photo: Johan Hurter)*

Box 10. Training of Law Enforcement Officers In the Identification of Endangered Plant Taxa

by Johan Hurter, Lowveld National Botanical Garden, P.O. Box 1024, Nelspruit 1200, South Africa

Inspection of cycads in gardens and nurseries sometimes constitutes up to sixty percent of the duties of Nature Conservation law enforcement officers in certain parts of South Africa. Old and new officers are taught cycad identification over a four-day period, using a new leaf key developed by the Lowveld National Botanical Garden for garden-grown and wild specimens of *Encephalartos*. In the past five years about 100 law enforcement officers have been trained.

Members of the Mpumalanga Parks Boards Conservation Services on a cycad identification course. (Photo: Lowveld NBG)

Conclusion

The network of southern African plant scientists developed as a result of the GEF/UNDP and USAID/IUCN ROSA-funded SABONET project has proved to be an important mechanism for cooperation, collaboration and capacity-building amongst botanists in the ten countries of southern Africa. Although many of the details still need to be worked out by the countries and participating institutions concerned, SABONET could, at least for the duration of the project, serve as the coordinating body for a regional network of botanical gardens in southern Africa. Preliminary results of this regional botanical gardens needs assessment have indicated that the staff attached to those gardens surveyed have relatively similar needs in terms of training, computerisation of plant records and general botanical garden management. These needs can be addressed by tailor-made training courses and workshops developed and conducted within the region. Closer collaboration, however, needs to be developed with national universities, herbaria and conservation agencies, as well as with the BGCI and other gardens and networks around the world.

PART 2.

Southern African Botanical Gardens

Botswana

National Botanical Garden (Gaborone)

Name of botanic(al) garden: Botswana National Botanical Garden
Postal address: Private Bag 114, Gaborone, Botswana
Physical address: Okwa Road, Opposite Gaborone Club, The Village, Gaborone
Telephone: [267] 373860
Fax: [267] 311186
E-mail: None
Director/Head of Institute: Ms Tickey Pule (Director: National Museum, Monuments and Art Gallery)
Curator and correspondent: Mr Nonofo Mosesane, b. 1964, BSc (Environmental Science and Biology), Diploma in Conservation Management and special interest in plant conservation and plant biology
Status: State
Foundation date: 1978
Mission: Under development
Size/area of garden: 7 ha
Landscaped area: 1 ha
Natural vegetation in garden: 6 ha
Acacia-dominated savanna: *Combretum, Peltophorum, Ximenia, Ficus, Pappea*
Latitude: 25°56'E
Longitude: 24°40'S
Altitude: 1 000 m a.s.l.
Rainfall: 400–450 mm per annum
Associated reserve: None
Number of paid staff: 7
Number of volunteers: None
Number and names of horticulturists: 2

- Mr Diphetogo Menyatso, b. 1968, Certificate in General Agriculture (Botswana College of Agriculture)
- Ms Barulaganye N. Lesetedi, b. 1975, Certificate in Forestry and Range Ecology/ Management (Botswana College of Agriculture)(special interest in plant taxonomy and plant conservation)

Number of labour staff: 4
Working hours/day: 7¾ (07h30–12h30; 13h45–16h30) weekdays
Associated staff: None
Planting records: Newly introduced and paper-based
Percentage indigenous plants: *ca* 90%
Threatened plants programme: None
Indoor exhibition area: None
Friends: None
Seed bank: No
Index seminum: None
Research facilities: No
Research:
Propagation
Ecology
Conservation
Ethnobotany
Field gene banks or living collections: Garden
In vitro *storage*: None
Pollen banks: None
DNA bank: None
Education programme:
Education section: Under National Museum
Number of staff: No staff specifically for botany or natural history
Courses for school children, students, adults: Museum education staff runs EE, but garden staff not involved
Courses on conservation: No
Environmental education: No
Public lectures: No
Permanent public displays: No
Special exhibitions: No
Public education/display building: In development programme
Issue booklets/leaflets: Brochure
Guided tours: No
Display labels: Early stage of development
Special facilities for children: No
Training courses: No
Horticultural herbarium: None, but see below
Number of specimens: None
Access to other herbarium:
National Herbarium (GAB)
University of Botswana Herbarium (UCBG)
Sebele Agricultural Herbarium (MAH)
Number of specimens: 15 000 (GAB); 2 000 (MAH); 10 000 (UCBG)
Infrastructure/facilities:
Visitor centre: In the development plan
Nurseries: 1 (3 x 9 m^2)
Greenhouses: None
Laboratories: No
Library: Access to Museum Library (long-term loan to National Herbarium from Museum Library)

Figure 12. The canal that passes through Botswana's National Botanical Garden and the building (middle) used to house the staff and natural history collections. (Photo: Christopher Willis)

Figure 13. A structure within Botswana's National Botanical Garden which is scheduled to be developed into a display house. (Photo: Christopher Willis)

Auditorium: None at present
Exhibition area: In development plan
Quarantine station: No
Bookshop: None, associated with the National Museum
Arboretum: Associated Sokwe Vegetation Reserve (1 x 1 km), 350 km NNW of Gaborone (Near Serowe)
Equipment:
Vehicles: Access to Museum vehicles
Lawnmowers: Two
Irrigation: None
Others: Brush cutters, hand tools
Number of plant taxa in garden: Not known
Plant families represented in garden:
Anacardiaceae
Capparidaceae
Combretaceae
Euphorbiaceae
Fabaceae
Moraceae
Poaceae
Number of threatened plant species in garden: Not known
Number of visitors per annum: Not known, *ad hoc* visits
Computerisation of collections: No
Floras/vegetation types represented in garden: *Acacia* savanna, granite inselberg vegetation
Open to public: During office hours
Entrance fee charged: No
Publications: *Zebra's Voice* (Quarterly Museum Newsletter); Natural History Brochure

Assessment of needs:
- Basic training in garden management for labour staff.
- Develop mission, vision, and masterplan for garden.
- Landscaping of various areas of garden, especially to ease the contrast between the landscaped and natural areas of the garden.
- Walking trails on rock outcrops using hiking trail markers (through use of template).
- Training from gardener level to MSc Level.
- Knowledge of EIAs.
- Botanical Latin.
- Propagation and cultivation of indigenous plants.
- Short-term attachments of staff to other botanical gardens in the region with similar vegetation (and from NBI Gardens to Gaborone).
- Chain saw operation, use of brush cutters.
- Landscape design.
- Field collecting techniques.
- Research techniques.
- Compost area preparation.
- Lawnmower maintenance.
- Use of chemicals.
- Environmental education.
- Interpretive signage, labelling of plants.
- Irrigation system installation and maintenance.
- Local training to identify plants.

Compilation date: 9–10 November 1998
Revised version: 23 November 1998
Second revised version: 15 June 2000

Lesotho

Katse Botanical Garden (Katse Dam)

Name of botanic(al) garden: Katse Botanical Garden
Postal address: P.O. Box 7332, Maseru 100 (LHDA offices)
Physical address: LHDA, Maseru Sun Cabannas Office Complex, Orpen Road, Maseru (Office No. 728)
Telephone: [266] 311280
Fax: [266] 316236
E-mail: mahlet@LHDA.org.ls
Assistant General Manager (Field Operations): Mahlape Mothepu, b. 1960, BSc (Applied Environmental Science), Cell: 850679
Curator and correspondent: Tau Mahlelebe, b. 1956, BSc (Range Science/Botany) Tel: 910209 (Katse); 311280 (Maseru); Cell: 858587
Status: Parastatal, Lesotho Highlands Development Authority (LHDA)
Foundation date: 1995
Mission: Katse Botanical Garden strives to promote a better knowledge and understanding of the alpine flora of Lesotho through propagation, cultivation and conservation of the indigenous plants; serve as an educational centre for local communities, students, scientists and the public at large.
Size/area of garden: 17 ha
Landscaped area: *ca* 8 ha
Natural vegetation in garden: Alpine Grassland (9 ha), Poaceae and Asteraceae are the dominant plant families.
Latitude: Information not available
Longitude: Information not available
Altitude: *ca* 2 150 m a.s.l.
Rainfall: *ca* 800 mm per annum
Associated reserve: None
Number of permanent staff: 2
Philemon Namane, b. 1943, Diploma in Business Studies, Tel. [266] 910377
Number of volunteers: None
Number and names of horticulturists: None
Number of labour staff: 23 (Contracted for specific tasks within the garden)
Working hours/day: 8 hours (07h00–16h00)
Associated staff: None
Planting records: Paper-based (not computerised)
Percentage indigenous plants: *ca* 90%
Threatened plants programme: Initial stages of development (*Aloe polyphylla* and medicinal plants)
Indoor exhibition area: Planned
Friends: None at present
Seed bank: Yes, through the National Plant Genetic Resources Centre, Maseru
Index seminum: No
Research facilities: No, possibly through the National University of Lesotho (Roma)
Research:
Horticulture
Propagation
Acclimatisation
Conservation
Germination
Ethnobotany
Medicinal plants
Propagation of indigenous species
Field gene banks or living collections: Living collections
In vitro *storage*: No
Pollen banks: None
DNA bank: None
Education programme: Formal programme planned, nothing at present
Education section: Nothing at present
Number of staff: None dedicated specifically to education
Courses for school children, students, adults: No
Courses on conservation: No
Environmental education: No
Public lectures: No
Permanent public displays: No
Special exhibitions: None
Public education/display building: No
Issue booklets/leaflets: No
Guided tours: No
Display labels: No
Special facilities for children: No
Training courses: Planned (plan to offer courses in conservation, targeted at the local communities and school children)
Horticultural herbarium: None (possibly planned)
Number of specimens: None
Access to other herbarium: Possibly through the Roma Herbarium (ROML) at the National University of Lesotho (NUL)
Number of specimens: 15 000
Infrastructure/facilities: Paths/terraces/irrigation

Figure 14. The newly developed medicinal plant section of the Katse Botanical Garden, Lesotho. (Photo: Christopher Willis)

Figure 15. Recently developed terraces that follow the contours in the Katse Botanical Garden, Lesotho. (Photo: Christopher Willis)

Figure 16. View from the Katse Botanical Garden, Lesotho, overlooking the cold waters of the Katse Dam and the surrounding mountains. One of the newly developed paths of the garden can be seen in the foreground. (Photo: Christopher Willis)

Visitor centre: Planned
Nurseries: 1
Greenhouses: Planned, still to be established
Laboratories: None
Library: Planned for Garden Office Building
Auditorium: Planned in Visitors' Centre
Exhibition area: Planned in Visitors' Centre
Quarantine station: None
Bookshop: Planned (part of Visitors' Centre)

Arboretum: Inside the garden (planned)

Equipment:
Vehicles: 1 4x4 Toyota Double Cab through LHDA
Lawnmowers: Manual (brushcutters)
Irrigation: Yes
Others: Spades, pick, axes

Number of plant taxa in garden: *ca* 400

Plant families represented in garden:
Alliaceae
Amaryllidaceae
Apiaceae
Araceae
Asphodelaceae
Asteraceae
Campanulaceae
Cannabaceae
Caryophyllaceae
Crassulaceae
Cyperaceae
Dipsacaceae
Equisetaceae
Euphorbiaceae
Fabaceae
Geraniaceae
Gunneraceae
Hyacinthaceae
Hypoxidaceae
Iridaceae
Juncaceae
Lamiaceae
Loganiaceae
Mesembryanthemaceae
Pinaceae
Poaceae
Rosaceae
Rubiaceae
Scrophulariaceae
Thymelaeaceae

Number of threatened plant genera in garden: 2 (*Aloe polyphylla; Kniphofia northiae; Kniphofia triangularis; Kniphofia caulescens*)

Number of visitors per annum: *ca* 200

Computerisation of collections: Planned

Floras/vegetation types represented in garden: Alpine Grassland Flora (few specimens from lower-lying areas of Lesotho)

Open to public: 07h00–16h00

Entrance fee charged: No

Publications: LHDA General Newsletter called *Mehloli*

Assessment of needs:
- Horticulturist.
- Plant labels.
- Interpretive signage/story boards.
- Plant Records Database.
- Guidance needed with nursery development.

Remarks:
- Very fertile soil.
- Terraces to be continued into contours.
- Network of gravel paths has been laid out in the garden, some terraces as well.
- Medicinal plants section has been started.

- *Aloe polyphylla* and *Kniphofia* spp. cultivated (threatened plants).
- Flora representative of the Senqu Valley planned for the valley section of garden, with possibility of filling existing dam and planting aquatic plants.
- Garden fenced, currently beautiful views of surrounding mountains and Katse Dam—view will be spoilt by the line of pine trees that has been planted along the inside of the fence.
- Pines planted as a border along the fence should be removed from the garden. In addition to aesthetic reasons, this invasive alien plant species could also spread to other adjacent areas.
- Garden on north and east-facing slopes.
- Certain areas (circular) planned for thatch shelters with a conical shape (similar to Basuto Hat).
- Indigenous grasses should be grouped in mass displays in clumps (labelled).
- Try not to remove stones from the garden itself in order to prepare paths, as this disturbs the site and facilitates erosion.
- Some paths are on a relatively steep gradient, and should use rocks to prevent erosion.
- 'Veld enrichment'—term used for local flora being brought into the garden from surrounding areas.

Compilation date: 18 February 1999

Figure 17. Lesotho's national flower, the spiral aloe (Aloe polyphylla)*, grown in the Katse Botanical Garden, Lesotho. (Photo: Christopher Willis)*

Malawi

Lilongwe National Botanic Garden (Lilongwe)

Name of botanic(al) garden: Lilongwe National Botanic Garden
Postal address: P.O. Box 30766 Capital City, Lilongwe 3, Malawi
Physical address: Area 14 plot 192, between Area 18 and Capital Hill Offices, Lilongwe, Malawi
Telephone: [265] 730 275
Fax: None
E-mail: None
Acting General Manager: Augustine C. Chikuni, b. 1964, PhD,augustine@sdnp.org.mw (*Brachystegia,* Fabaceae; *Achyrospermum,* Lamiaceae; general plant systematics)
Curator and correspondent: Mr Ignatius Augustine Malota (Malawian indigenous plant horticulture)
Status: State
Foundation date: 1989 (on inception of NHBG)
Mission: To develop Lilongwe National Botanic Garden to serve conservation, education, recreation, training and research in indigenous and exotic species.
Size/area of garden: 130.68 ha
Landscaped area: *ca* 30 ha
Latitude: 13°56'S–15°58'S
Longitude: 33°46'E–35°47'E
Altitude: 1 100 m a.s.l.
Rainfall: 2 000 mm per annum
Associated reserve: Not applicable
Number of paid staff: 5
Number of volunteers: None
Number and names of horticulturists: 1
Mr Ignatius A. Malota, Diploma in Agriculture (Malawian indigenous plant horticulture)
Number of labour staff: 26
Working hours/day: 8.5 hrs (07h30–12h00; 13h00–17h00)
Associated staff: None
Planting records: None
Percentage indigenous plants: 50%
Threatened plants programme: None, currently being initiated
Indoor exhibition area: None
Friends: None
Seed bank: None
Index seminum: None
Research facilities: None
Research:
Horticulture
Taxonomy
Propagation
Conservation
Germination
Propagation of indigenous plants
Field gene banks or living collections: Living collections
In vitro *storage*: None
Pollen banks: None
DNA bank: None
Education programme:
Education section: No
Number of staff: None
Courses for school children, students, adults: None
Courses on conservation: None
Environmental education: Yes, but no formal EE programme
Public lectures: None
Permanent public displays: None
Special exhibitions: None
Public education/display building: None
Issue booklets/leaflets: None
Guided tours: No
Display labels: None
Special facilities for children: None
Training Courses: No
Horticultural herbarium: None
Number of specimens: None
Access to other herbarium: National Herbarium of Malawi (MAL)
Number of specimens: *ca* 100 000
Infrastructure/ facilities:
Visitor centre: No
Nurseries: Yes, locally made
Greenhouses: One screen house (12 m x 30 m); One 5 m x 3 m plastic
Laboratories: None
Library: None
Auditorium: None
Exhibition area: None
Quarantine station: None
Bookshop: None
Arboretum: None
Equipment:
Vehicles: 1
Lawnmowers: 2
Irrigation: Partly—pipes laid in one area; water pumped from underground source to a tank; from there water moves by gravity.

Figure 18. Part of Lilongwe National Botanic Garden is reserved for a demonstration orchard where mangoes, guavas, oranges, granadillas, peaches and apples are grown. (Photo: Augustine Chikuni)

Others: Wheelbarrows, sprayers, slashers, hoes, spades, rakes, watering cans
Number of plant taxa: Uncertain
Plant families represented in the garden:
Acanthaceae
Amaranthaceae
Anacardiaceae
Annonaceae
Apocynaceae
Bignoniaceae
Boraginaceae
Combretaceae
Euphorbiaceae
Leguminosae
Loganiaceae
Malvaceae
Moraceae
Poaceae
Rhamnaceae
Rubiaceae
Solanaceae
Verbenaceae
Number of threatened plant species: Records incomplete
Number of visitors per annum: Uncertain
Computerization of collection: No

Floras/vegetation types represented in garden: *Combretum-Acacia* woodland
Open to public: Yes, all week (Monday to Sunday; no official times)
Entrance fee charged: Groups charged MK50 per group. Individuals free entry.
Publications: None
Assessment of needs:
- Need to revise and complete master plan for the garden.
- Need for lawnmower and tractor.
- Need to construct paths and shelters.
- Identification and propagation of threatened plants.
- Interpretive signage required.
- Labelling plants in the garden.
- Develop a living plant collection.
- Need for new offices.
- Botanic garden literature.
- Development of a curation policy.
- Need to decide major plant groups to be planted in the garden.

Training needs for staff:
- BSc in Horticulture.
- Staff exchange or attachments.
- Practical garden management (hands on training).

- Landscape design of botanic gardens.
- Environmental Education Programmes.
- Propagation techniques (seeds, grafting, budding and others).
- Irrigation techniques.
- Use of computers/databases in botanic garden management.

Remarks: The office is made of wooden planks and this is always prone to entry by thieves; there is great need for new offices. The garden is conveniently situated for visitors coming from the airport and all regions of the country. It is accessible by minibuses and taxis.
Compilation date: 18 July 2000

Figure 19. Lilongwe National Botanic Garden. Most of the ornamentals are propagated in a screen house constructed with funds from DFID. (Photo: Augustine Chikuni)

Figure 20. Lilongwe National Botanic Garden. This landscaped area was dominated by Acacia *before it was cleared in the 1970s to be replaced by* Gmelina arborea. (Photo*: Augustine Chikuni)*

Figure 21. A part of Lilongwe National Botanic Garden dominated by Combretum *species and* Piliostigma thonningii. *(Photo: Augustine Chikuni)*

Mzuzu National Botanic Garden (Mzuzu)

Name of botanic(al) garden: Mzuzu National Botanic Garden
Postal address: P.O Box 689 Mzuzu, Malawi
Telephone: None, use c/o [265] 525388/145/118
Fax: None, use c/o [265] 524108
E-mail: None
Acting General Manager: Augustine C. Chikuni, b. 1964. PhD, augustine@sdnp.org.mw (*Brachystegia,* Fabaceae; *Achyrospermum,* Lamiaceae; general plant systematics)
Curator and correspondent: Vacant
Status: State
Foundation date: 1989
Mission: To develop Mzuzu National Botanic Garden to serve conservation, education, recreation, training and research in indigenous and exotic species.
Size/area of garden: 478.4 ha
Landscaped area: *ca* 6 ha
Latitude: 11°25'S–11°26'S
Longitude: 34°00'E–34°06'E
Altitude: 950 m a.s.l.
Rainfall: 3 000 mm per annum
Associated reserve: None
Number of paid staff: 7
Number of volunteers: None
Number and names of horticulturists: 1
Mr A.D.K. Nkhonjera (Horticulture Assistant National Trade Test Grade 1)
Number of labour staff: 17
Working hours/day: 8.5 hrs (07h30–12h00; 13h00–17h00)
Associated staff: None
Planting records: None
Percentage indigenous plants: 99%
Threatened plants programme: None, currently being initiated
Indoor exhibition area: None
Friends: None
Seed bank: No. Seed stored in office.
Index seminum: None
Research facilities: None
Research:
Horticulture
Conservation
Germination
Propagation of indigenous plants

Field gene banks or living collections: Living collections
In vitro *storage*: None
Pollen banks: None
DNA bank: None
Education programme:
Education section: No
Number of staff: None
Courses for school children, students, adults: None
Courses on conservation: None
Environmental education: Yes, but no formal EE programme
Public lectures: None
Permanent public displays: None
Special exhibitions: None
Public education/display building: None
Issue booklets/leaflets: None
Guided tours: No
Display labels: None
Special facilities for children: None
Training Courses: Yes. Horticulture
Horticultural herbarium: None
Number of specimens: None
Access to other herbarium: National Herbarium of Malawi (MAL)
Number of specimens: *ca* 100 000
Infrastructure/ facilities:
Visitor centre: No
Nurseries: Yes, locally made
Greenhouses: None
Laboratories: None
Library: None
Auditorium: None
Exhibition area: None
Quarantine station: None
Bookshop: None
Arboretum: None
Equipment:
Vehicles: 1
Lawnmowers: None
Irrigation: No
Others: Wheelbarrows, sprayers, slashers, hoes, spades, rakes, watering cans
Number of plant taxa: Uncertain
Plant families represented in the garden:
Acanthaceae
Amaranthaceae
Amaryllidaceae
Anacardiaceae
Apiaceae
Apocynaceae
Asparagaceae
Asteraceae
Bignoniaceae
Combretaceae
Commelinaceae
Convolvulaceae

Figure 22. Mzuzu National Botanic Garden. Most of the garden is a botanical reserve dominated by Brachystegia taxifolia, Uapaca nitida *and* Uapaca kirkiana. *The past ten years of intensive protection have resulted in regeneration of the vegetation. Initial funding for some activities was provided by the British High Commission. (Photo: Augustine Chikuni)*

Cucurbitaceae
Cyperaceae
Euphorbiaceae
Iridaceae
Lamiaceae
Leguminosae
Malvaceae
Melastomataceae
Moraceae
Orchidaceae
Poaceae
Polygalaceae
Rhamnaceae
Rosaceae
Rubiaceae
Santalaceae
Sapindaceae
Scrophulariaceae
Solanaceae
Verbenaceae
Vitaceae

Number of threatened plant species: Records incomplete
Number of visitors per annum: Uncertain
Computerization of collection: No
Floras/vegetation types represented in garden: *Uapaca-Brachystegia* woodland
Open to public: Yes, all week (Monday to Sunday; no official times)
Entrance fee charged: Groups charged MK 50 per group. Individuals free entry.
Publications: None
Assessment of needs:

- Develop a master plan for the garden.
- Employment of one horticulturist.
- Identification and propagation of threatened plants.
- Interpretive signage required.
- Labelling of important plants in the garden.
- Need for new offices.
- Development of a curation policy.
- Need to decide major plant groups to be planted in the garden.

Training needs for staff:

- Staff exchange or attachments.
- Practical garden management (hands-on training).
- Diploma in Horticulture.
- Environmental Education Programmes.
- Propagation techniques (seeds, grafting, budding and others).
- Botanic Garden Management.

Remarks: The garden is used as a conservation area of indigenous plant species and most of them have regenerated and grown into big trees and shrubs. There is no proper office.
Compilation date: 18 July 2000

Figure 23. A small portion of Mzuzu National Botanic Garden has been landscaped. Landscaping is expected to continue once the master plan is in place. (Photo: Augustine Chikuni)

Figure 24. Communities are allowed to collect thatching grass from Mzuzu National Botanic Garden. This has improved community participation in the management of garden resources. (Photo: Augustine Chikuni)

Figure 25. Staff at Mzuzu National Botanic Garden collect and propagate seed of rare species in the nursery on a small scale. The seedlings are sold or donated to interested individuals. (Photo: Augustine Chikuni)

Zomba National Botanic Garden (Zomba)

Name of botanic(al) garden: Zomba National Botanic Garden
Postal address: Zomba NBG, National Herbarium and Botanic Gardens of Malawi (NHBG), P.O. Box 528, Zomba, Malawi
Physical address: Junction of Livingstone and Old Naisi Road, above Government Printer and Parliament Buildings, Zomba, Malawi
Telephone: [265] 525 388/118/145
Fax: [265] 524 108
E-mail: herbarium@chirunga.sdnp.org.mw
Officer-in-charge: Augustine C. Chikuni, b. 1964, PhD, augustine@sdnp.org.mw (*Brachystegia*, Fabaceae; *Achyrospermum*, Lamiaceae; general plant systematics)
Curator and correspondent: Mphamba Wayera Kumwenda, b. 1965, BSc (Agriculture), mkumwenda@chirunga.sdnp.org.mw (Malawian indigenous plant horticulture)
Status: State
Foundation date: Between 1891 and 1895
Mission: To develop the Zomba National Botanic Garden to serve conservation, education, recreation, training and research in native and exotic species.
Size/area of garden: *ca* 50 ha
Landscaped area: *ca* 30 ha
Natural vegetation in garden: *ca* 20 ha
Latitude: 15°22.2'S–15°22.5'S
Longitude: 35°19.6'E–35°19.8'E
Altitude: 1 000 m a.s.l.
Rainfall: 2 000 mm per annum
Associated reserve: None
Number of paid staff: 13
Number of volunteers: None
Number and names of horticulturists: 2

- Mphamba Wayera Kumwenda, b. 1965, BSc (Agriculture), kumwenda@chirunga.sdnp.org.mw (Malawian indigenous plant horticulture)
- Lloyd G. Nkoloma, b. 1944, Diploma (Horticulture), herbarium@chirunga.sdnp.org.mw (Malawian indigenous plant horticulture, landscape architecture)

Number of labour staff: 24
Working hours/day: 8.5 (07h30–12h00; 13h00–17h00)
Associated staff: None

Figure 26. The Mulunguzi River runs through the Zomba National Botanic Garden, forming a habitat for a variety of aquatic plant species. (Photo: Augustine Chikuni)

Figure 27. Environmental education at Zomba National Botanic Garden. Instilling environmental awareness in the future leaders of Malawi. (Photo: Augustine Chikuni)

Figure 28. Environmental education at Zomba National Botanic Garden. Introducing the concept of the ecological approach in biodiversity conservation by using a web of life analogy. (Photo: Augustine Chikuni)

Planting records: None
Percentage indigenous plants: 80%
Threatened plants programme: None, currently being initiated, with emphasis on orchids and aloes.
Indoor exhibition area: None
Friends: Support for Zomba National Botanic Garden received from Rev. Stewart Lane (The Polytechnic, Private Bag 303, Chichiri, Blantyre 3, Malawi) and Mrs P. Royle (Private Bag 1, Bvumbwe, Malawi); Wildlife Society of Malawi, P.O. Box 1429, Blantyre, Malawi.
Seed bank: No. Seed stored in offices.
Index seminum: Last produced in 1995. Currently none available.
Research facilities: No. Laboratories and equipment available through the University of Malawi, Zomba.
Research:
Horticulture
Physiology
Propagation
Conservation
Germination
Mycology
Ethnobotany
Medicinal plants
Propagation of indigenous species
Field gene banks or living collections: Garden living collections
In vitro *storage*: None
Pollen banks: None
DNA bank: None
Education programme:
Education section: No. Use existing staff (both herbarium and botanic garden staff).
Number of staff: 8 (garden and herbarium staff)
Courses for school children, students, adults: No courses offered, but talks presented to school children, traditional healers, students and adults.
Courses on conservation: No
Environmental education: Yes, but no formal EE programme.
Public lectures: No
Permanent public displays: No
Special exhibitions: No
Public education/display building: None
Issue booklets/leaflets: Leaflet available on the Zomba National Botanic Garden.
Guided tours: Yes
Display labels: Some. Need support here. Vandalism a problem, even though labels cemented to substrate.
Special facilities for children: None

Figure 29. The Aloe ex situ *conservation programme at Zomba National Botanic Garden. The aloes were collected from the wild with funding from SABONET. Exotic species were donated by friends of the Botanic Garden. (Photo: Augustine Chikuni)*

Training courses: No
Horticultural herbarium: None
Number of specimens: None
Access to other herbarium: National Herbarium of Malawi (MAL), situated above the Zomba National Botanic Garden
Number of specimens: *ca* 100 000
Infrastructure/facilities:
Visitor centre: No
Nurseries: One
Greenhouses: One (5 x 5 m, plastic)
Laboratories: University of Malawi, Zomba
Library: Yes
Auditorium: None
Exhibition area: Temporary, associated with the herbarium
Quarantine station: None
Bookshop: None
Arboretum: One, Mulanje Arboretum
Equipment:
Vehicles: Access to NHBG vehicles
Lawnmowers: 2
Irrigation: Being planned
Others: Wheelbarrows, sprayers, slashers, hoes, spades, rakes, watering cans
Number of plant taxa: Uncertain, more than 300
Plant families represented in garden:
Aloaceae
Araucaceae
Euphorbiaceae
Fabaceae
Meliaceae
Zamiaceae
Number of threatened plant species in garden: Records incomplete
Number of visitors per annum: *ca* 1 200 (official); many unofficial visitors
Computerisation of collections: No
Floras/vegetation types represented in garden: Semi-evergreen riverine
Open to public: Yes. All week (Monday to Sunday; no official times).
Entrance fee charged: Groups charged MK50 per group. Individuals free entry.
Publications: No regular publications; *List of trees, shrubs and woody climbers of Zomba Botanic Garden* available.
Assessment of needs:
- Garden needs to be fenced.
- Master Plan to be developed.
- Identification and propagation of threatened plants.
- Botanic garden literature.
- Shade house.
- Irrigation.
- Waterpump.
- Develop a plant collections policy.
- Develop living plant collections.
- Need to decide what major plant groups should be planted in the garden.
- Facility to store compost.
- Quarantine area.
- Label machine or labels from the National Botanical Institute.
- Need to give plants accession numbers.
- Computer and database.
- Interpretive signage.
- Stevenson screen for recording weather statistics (should investigate obtaining such a screen from the Malawi Meteorological Services).
- Shed, paths.

Training needs for staff:
- Horticulture at MSc level.
- Staff exchanges/attachments.
- Practical garden management (hands-on training).
- Landscape design of botanic gardens.
- Financial management/budget control.
- Propagation techniques (seeds, grafting, budding, and others).
- Irrigation techniques.
- Use of computers/databases in botanic garden management.

Remarks:
- Funds generated go into the general fund of the National Herbarium and Botanic Garden, and not the botanic garden specifically.
- Remove invasive plants, such as Mauritius thorn, syringa and jacaranda from the Zomba NBG.
- Document experiments, propagation successes/failures.
- Plants not wanted in the garden should be removed.

Compilation date: 27 August 1998
Updated: 18 July 2000

Mozambique

INIA Botanical Garden (Maputo)

Name of botanic(al) garden: INIA Botanical Garden (INIA=National Institute of Agronomic Research)
Postal address: INIA, C.P. 3658, Mavalane, Maputo, Mozambique
Physical address: INIA, F.P.L.M. Avenue, Mavalane, Maputo, Mozambique
Telephone: [258] 1/ 460097 or 460190
Fax: [258] 1/ 460074
E-mail: martamanjate@yahoo.com, sizidine@yahoo.com
Director/Head of Institute: Mr Rafael Uaine
Curator and correspondent: Mrs Marta Manjate, b. 1964, BSc (Biology), martamanjate@yahoo.com
Status: State
Foundation date: 1968
Mission: None available
Size/area of garden: 16 ha
Landscaped area: 25%
Natural vegetation in garden: 75%
Latitude: 25°58'S
Longitude: 32°30'E
Altitude: 60 m a.s.l.
Rainfall: 600–1 200 mm per annum
Associated reserve: Bobole Nature Reserve (which includes specimens of *Raphia australis*); 12 771 m²
Number of paid staff: 7 (Marta Manjate and six labour staff)
Number of volunteers: None
Number and names of horticulturists: None
Number of labour staff: 2
Working hours/day: 07h30–17h30 (2-hour lunch break)
Associated staff: None
Planting records: No
Percentage indigenous plants: 90%
Threatened plants programme: Planned
Indoor exhibition area: No
Friends: No
Seed bank: Yes (National Gene Bank). Separate building in grounds of garden.
Index seminum: Planned
Research facilities: LMA Herbarium; it is planned to move the Tissue Culture Laboratory to INIA
Research:
Horticulture (planned)
Taxonomy (through LMA Herbarium)
Propagation (planned)
Conservation (planned)
Forestry
Germination (planned)
Ethnobotany
Medicinal plants
Tissue culture (planned)
Propagation of indigenous species (planned)
Field gene banks or living collections: Living collections in garden
In vitro *storage*: None
Pollen banks: None
DNA bank: None
Education programme: Planned, student visits, lectures
Education section: No
Number of staff: None
Courses for school children, students, adults: Planned
Courses on conservation: Planned
Environmental education: Yes
Public lectures: Planned
Permanent public displays: No
Special exhibitions: None
Public education/display building: None
Issue booklets/leaflets: No
Guided tours: No
Display labels: No
Special facilities for children: No
Training courses: No
Horticultural herbarium: No
Number of specimens: None
Access to other herbarium: LMA Herbarium
Number of specimens: 62 000
Infrastructure/facilities:
Visitor centre: None
Nurseries: 1
Greenhouses:
2 (20 x 10 m)(need rehabilitation)
Potting shed (needs rehabilitation)
Laboratories: Planned
Library: LMA Herbarium library
Auditorium: None
Exhibition area: None
Quarantine station: Yes
Bookshop: No
Arboretum: Inside garden
Equipment:
Vehicles: None dedicated
Lawnmowers: Manual cutting of grass
Irrigation: 2 boreholes and watering system, which needs upgrading/rehabilitation.

Others: Hoes, spades, slashers
Number of plant taxa in garden: *ca* 250 (although an intensive inventory is needed)
Plant families represented in garden:
Agavaceae
Anacardiaceae
Apocynaceae
Areliaceae
Asphodelaceae
Bignoniaceae
Bombacaceae
Burseraceae
Cactaceae
Canellaceae
Casuarinaceae
Combretaceae
Euphorbiaceae
Fabaceae
Liliaceae *(sensu lato)*
Loganiaceae
Lythraceae
Malvaceae
Meliaceae
Moraceae
Musaceae
Nyctaginaceae
Ochnaceae
Palmae
Passifloraceae
Pinaceae
Poaceae
Polygalaceae
Rhamnaceae
Rubiaceae
Sapotaceae
Verbenaceae
Zamiaceae
Number of threatened plant species in garden: *ca* 10 species
Number of visitors per annum: *ca* 200 (Secondary schools, university students, traditional healers)
Computerisation of collections: No (planned)
Floras/vegetation types represented in garden: Savanna, coastal vegetation
Open to public: Yes, 07h30–17h30
Entrance fee charged: No
Publications: None
Assessment of needs:
- Additional borehole on the lower area of the garden.
- Landscape architecture.
- Labelling.
- Plant record system.

Training needs for staff:
- MSc course in plant horticulture.

Figure 30. Derelict glasshouses in the INIA Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis)

- Short course training in garden management.
- Short course training in plant conservation techniques.
- Short-term training in plant propagation and multiplication.
- Environmental education in botanic gardens.

Remarks:
- Large potting shed could be renovated; break down filled-in parts of walls, fix roof, clean, etc. Basic structure still sound.
- Renovation of greenhouses probably not necessary at present
- Start with development of arboretum section of garden, labelling of plants (especially trees).
- Inventory plant taxa in garden (preliminary list is available).
- Irrigation system needs upgrading/expanding.
- Develop strategic/master plan for garden, also develop vision and objectives.
- Remove exotics from sections of arboretum.
- Ideal climate for growing subtropical plants.
- Need to involve people of Maputo.
- Need more permanent trained staff in the long-term, working in garden.
- Need trained horticulturist.
- Create something in garden that is unique.
- Use of volunteers in managing garden.
- Botanic garden comprises sandy soil, nutrient-rich, plants grow well

Compilation date: 9 February 1999
Updated: 11 September 2000

Tunduru Botanical Garden (Maputo)

Name of botanic(al) garden: Tunduru Botanical Garden
Postal address: Tunduru Botanical Garden, P.O. Box 251, Maputo, Mozambique
Physical address: Avenida Samora Machel
Telephone: [258] 1/ 424654
Fax: Not available
E-mail: Not available
Director/Head of Institute: Joaquim de Sousa, b. 1937, 2° Industrial School (Civil Construction)
Curator and correspondent: Joaquim de Sousa, b. 1937, 2° Industrial School (Civil Construction)
Status: Municipal
Foundation date: 1885
Mission: To introduce exotic and indigenous species.
Size/area of garden: 6.4 ha
Landscaped area: 100%
Natural vegetation in garden: 0%
Latitude: 25°58'S
Longitude: 32°27'E
Altitude: 30 m a.s.l.
Rainfall: Figures not available
Associated reserve: None
Number of paid staff: 58
Number of volunteers: None
Number and names of horticulturists: None
Number of labour staff: 45
Working hours/day: 07h00–17h00 (1 hour lunch)
Associated staff: None
Planting records: Yes. A. Balsinhas (1974)
Percentage indigenous plants: Unknown
Threatened plants programme: Some threatened plants in the greenhouse
Indoor exhibition area: Greenhouse
Friends: No
Seed bank: No
Index seminum: None
Research facilities: No, available through INIA
Research: None
Field gene banks or living collections: Living collections in the garden and greenhouse
In vitro *storage*: No
Pollen banks: No
DNA bank: No
Education programme: None
Education section: None
Number of staff: Not relevant
Courses for school children, students, adults: No
Courses on conservation: No
Environmental education: No
Public lectures: No
Permanent public displays: None

Special exhibitions: No
Public education/display building: None
Issue booklets/leaflets: None
Guided tours: No
Display labels: No
Special facilities for children: No
Training courses: None
Horticultural herbarium: No
Number of specimens: Not relevant
Access to other herbarium: LMA (National Herbarium), INIA
Number of specimens: 62 000
Infrastructure/facilities:
Visitor centre: No
Nurseries: 1
Greenhouses: 1 (1 800 m^2)
Laboratories: None
Library: No
Auditorium: No
Exhibition area: Greenhouse
Quarantine station: No
Bookshop: None
Arboretum: Inside garden
Equipment:
Vehicles: Old car
Lawnmowers: No
Irrigation: Natural spring in the garden. Water pumped from the spring to a large tank.
Others: Manual equipment
Number of plant taxa in garden: *ca* 230
Plant families represented in garden:
Acanthaceae
Anacardiaceae
Annonaceae
Araliaceae
Bignoniaceae
Bixaceae
Cactaceae
Capparidaceae
Caricaceae
Combretaceae
Convolvulaceae
Ebenaceae
Euphorbiaceae
Fabaceae
Fagaceae
Juglandaceae
Lauraceae
Liliaceae *(sensu lato)*
Lythraceae
Magnoliaceae
Malpighiaceae
Malvaceae

Figure 31. The large wooden greenhouse which serves as one of the central features of the Tunduru Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis)

Melastomataceae
Meliaceae
Moraceae
Musaceae
Myrtaceae
Nyctaginaceae
Oleaceae
Palmae
Pandanaceae
Pinaceae
Rhamnaceae
Rubiaceae
Rutaceae
Sapindaceae
Sapotaceae
Solanaceae
Sterculiaceae
Ulmaceae
Verbenaceae

Number of threatened plant species in garden: Unknown

Number of visitors per annum: *ca* 2 000 (not recorded)
Computerisation of collections: No
Floras/vegetation types represented in garden: Mainly exotic
Open to public: 06h00–18h00 (summer); 06h00–17h30 (winter)
Entrance fee charged: No
Publications: No. Newsletter produced (*Boletim Municipal*) before independence, but not since then.
Assessment of needs:

- Staff training in horticulture, garden management, plant records/computerisation (currently no computers in garden).
- Vehicle: tractor.
- Spraying equipment.

Remarks:

- Education programme started with LMU in December 1998.

Compilation date: 9 February 1999

Figure 32. Inside the Tunduru greenhouse. (Photo: Christopher Willis)

University Botanical Garden (Maputo)

Name of botanic(al) garden: University Botanical Garden
Postal address: University Botanical Garden, Department of Biological Sciences, C.P. 257, Maputo, Mozambique
Physical address: University Botanical Garden, Eduardo Mondlane University, Maputo
Telephone: [258] 1/ 491 223
Fax: [258] 1/ 492 192/492 176
E-mail: botanica@zebra.uem.mz
Curator and correspondent: Salomão O. Bandeira, b. 1965, MSc (Marine Botany), sband@zebra.uem.mz
Status: University
Foundation date: 1976
Mission: The University Botanical Garden aims to serve as a reference botanical garden in Mozambique, involved with the promotion and conservation of Mozambican plants, especially the most intensively used plant species and species of concern. This botanical garden also envisages the promotion of education and research in botany and related fields.

Size/area of garden: 6–8 ha
Landscaped area: 80%
Natural vegetation in garden: 20%, *Sclerocarya, Ozoroa, Strychnos, Poaceae, Phyllanthus*
Latitude: 25°57'S
Longitude: 32°36'E
Altitude: 25 m a.s.l.
Rainfall: 600–800 mm per annum
Associated reserve: None
Number of paid staff: Three technicians and 16 garden workers

- Ernesto Nacamo Amamo, b. 1966, Diploma in Agriculture, amamo66@hotmail.com
- Filomena M.A. Barbosa, b. 1959, BSc (Hons) Botany, filomena@zebra.uem.mz
- Alberto Lucas Matine, b. 1936, Primary School (Standard 4)

Number of volunteers: None
Number and names of horticulturists: None
Number of labour staff: 6
Working hours/day: 07h30–16h30 (Break for two hours, midday)
Associated staff: None
Planting records: Currently paper-based; planned to be computerised
Percentage indigenous plants: 90%
Threatened plants programme: Planned

Figure 33. Manual cutting of the grass, University Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis)

Figure 34. Aloe garden, University Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis)

Indoor exhibition area: None
Friends: Planned as part of strategic plan
Seed bank: Yes
Index seminum:Yes
Research facilities: Yes, through the LMU Herbarium and Eduardo Mondlane University laboratories
Research:
Taxonomy
Physiology
Ecology
Conservation
Ethnobotany
Medicinal plants
Tissue culture
Propagation of indigenous species
Field gene banks or living collections: Garden
In vitro *storage*: No
Pollen banks: None
DNA bank: None
Education programme: Planned
Education section: No
Number of staff: None dedicated to education
Courses for school children, students, adults: None
Courses on conservation: None
Environmental education: No
Public lectures: No
Permanent public displays: None
Special exhibitions: No
Public education/display building: None
Issue booklets/leaflets: No
Guided tours: No
Display labels: No
Special facilities for children: No
Training courses: No
Horticultural herbarium: No
Number of specimens: Not relevant
Access to other herbarium: LMU Herbarium
Number of specimens: 60 000
Infrastructure/facilities:
Visitor centre: None
Nurseries: 1
Greenhouses: 1
Laboratories: University
Library: LMU Herbarium Library
Auditorium: No
Exhibition area: None
Quarantine station: No
Bookshop: No
Arboretum: Inside garden
Equipment:
Vehicles: Shared with Department (not dedicated)
Lawnmowers: Manual
Irrigation: Yes, municipal

Number of plant taxa in garden: *ca* 200
Plant families represented in garden:
Amaryllidaceae
Apocynaceae
Asclepiadaceae
Asphodelaceae
Bignoniaceae
Bombacaceae
Burseraceae
Canellaceae
Capparaceae
Clusiaceae
Cyperaceae
Dracaenaceae
Ebenaceae
Euphorbiaceae
Fabaceae
Hypoxidaceae
Liliaceae *(sensu lato)*
Loganiaceae
Meliaceae
Mesembryanthemaceae
Moraceae
Myrtaceae
Orchidaceae
Poaceae
Vitaceae
Zamiaceae
Number of threatened plant species in garden: 15–20
Number of visitors per annum: *ca* 1 000
Computerisation of collections: Planned
Floras/vegetation types represented in garden: Coastal vegetation, garden based on economic uses of plant species
Open to public: Not officially, by appointment only
Entrance fee charged: No
Publications: Internal publication, *Index Seminum* published biennially
Assessment of needs:
- Water tank (not a big problem).
- Horticultural training (as for other gardens).
- Accessioning of plants/landscaping.
- Creation of paths.
- Small equipment.
- Lawnmower (diesel-powered).
- Labelling.
- Interpretive signage.
- Environmental education training.
- Garden management.
- Plant records databasing.
- Special pots for the orchidarium.
- Improvements to the nursery.
- Improvements to the greenhouse.
- Irrigation.

Remarks:
Strategic plan currently planned for garden.
Compilation date: 10 February 1999
Updated: 22 June 2000

Figure 35. Display label for Aloe parvibracteata, *University Botanical Garden, Maputo, Mozambique. (Photo: Christopher Willis)*

Namibia

National Botanic Garden (Windhoek)

Name of botanic(al) garden: National Botanic Garden (former SWA Nature Garden), National Botanical Research Institute, Windhoek, Namibia
Postal address: National Botanic Garden, Private Bag 13184, Windhoek, Namibia
Physical address: 8 Orban Street, Windhoek Central, Windhoek, Namibia
Telephone: [264] 61/ 202 2011 (Henk Dauth); [264] 61/ 202 2016 (Ben Strohbach)
Fax: [264] 61/ 258 153
E-mail: nbri@mweb.com.na
Director/Head of Institute: Gillian L. Maggs-Kölling, b. 1962, PhD, gmk@mweb.com.na (Cucurbitaceae)
Curator and correspondent: J. Hendrik (Henk) Dauth, b. 1971, N.D. Hort. (use of indigenous Namibian plants in general horticulture)
Status: State
Foundation date: 1969
Mission: The National Botanic Garden of Namibia strives to protect and promote the sustainable utilisation of the Namibian flora and to function as an educational and recreational nature facility for Namibians and visitors alike.
Size/area of garden: 12 ha
Landscaped area: 0%
Natural vegetation in garden: 100% *(Acacia, Aloe, Stipagrostis, Eragrostis, Aristida)*
Latitude: 22°34'05"S
Longitude: 17°E05'53"E
Altitude: 1 700 m a.s.l.
Rainfall: 360 mm per annum
Associated reserve: None
Number of paid staff: 6
Number of volunteers: None
Number and names of horticulturists: 1
J. Hendrik (Henk) Dauth, b. 1971, N.D. Hort. (use of indigenous Namibian plants in general horticulture)
Number of labour staff: 5
Working hours/day: 8 hours
Associated staff:
Ben J. Strohbach, b. 1965, MSc, bens@mweb.com.na (agro-ecological and vegetation resources survey of Namibia)
Planting records (computer/paper-based/none/in progress): None. Checklist of garden flora available.
Percentage indigenous plants: 99%
Threatened plants programme: None
Indoor exhibition area: Display house; desert section (135 m^2); tropical section planned (81 m^2)
Friends: The Botanical Society of Namibia, P.O. Box 24892, Windhoek, Namibia. Contact: Rowena Mould, Tel: [264] 61/ 223 829, fax: [264] 61/259 756, e-mail: mouldwhk@iafrica.com.na
Seed bank: No
Index seminum: None
Research facilities: Yes. National Botanical Research Institute (NBRI), Windhoek, Namibia.
Research: Options indicated only relevant to the NBRI
Taxonomy
Ecology
Conservation
Medicinal plants
Tissue culture [PALM-DAT (building situated adjacent to the NBRI)]
Field gene banks or living collections: Garden
In vitro *storage*: National Gene Bank linked to the NBRI
Pollen banks: No
DNA bank: No
Education programme: None
Education section: No
Number of staff: Use existing staff, no staff dedicated specifically to education
Courses for school children, students, adults: No
Courses on conservation: No
Environmental education: No
Public lectures: No
Permanent public displays: No
Special exhibitions: No
Public education/display building: None
Issue booklets/leaflets: Z-folder available on the National Botanic Garden
Guided tours: Guided tours of garden given to school children and tourists
Display labels: Yes, designed and produced using an in-house engraving machine
Special facilities for children: None
Training courses: None offered
Horticultural herbarium: No
Number of specimens: None

Access to other herbarium: National Herbarium of Namibia (WIND)
Number of specimens: 65 000
Infrastructure/facilities:
Visitor centre: None
Nurseries: One
Greenhouses: 2 x 8 m^2 greenhouses
Laboratories: NBRI
Library: The M.A.N. Müller Library inside the NBRI
Auditorium: Lecture Hall inside the NBRI
Exhibition area: None. Planned.
Quarantine station: None
Bookshop: None
Arboretum: None
Equipment:
Vehicles: 1 Nissan 2x4 one-ton Hardbody
Lawnmowers: 1
Irrigation: None. Problem with water availability. No water reticulation system. One 15 m hosepipe.
Others: 1 brush cutter; 1 chain saw; wheelbarrows; small tools adequate; electrical/workshop equipment adequate; diesel concrete mixer
Number of plant taxa: 120 (checklist of plant taxa in garden is available)

Plant families represented in garden:
Acanthaceae
Aloaceae
Anacardiaceae
Asteraceae
Capparaceae
Combretaceae
Crassulaceae
Fabaceae
Lamiaceae
Poaceae
Scrophulariaceae
Vitaceae
Number of threatened plant species in garden: *ca* 5
Number of visitors per annum: *ca* 200
Computerisation of collections: No
Floras/vegetation types represented in garden: Highland savanna with introductions from Kaokoveld and the Namibian escarpment
Open to public: Monday to Friday, 08h00–17h00
Entrance fee charged: None
Publications: Z-folder pamphlet
Assessment of needs:
- Urgent need to develop master plan for garden.

Figure 36. The building housing the National Botanical Research Institute adjacent to the National Botanic Garden, Namibia. (Photo: Christopher Willis)

*Figure 37. Quiver tree (*Aloe dichotoma*) forest, National Botanic Garden, Namibia. (Photo: Christopher Willis)*

- Once master plan has been completed, plan collecting trips to develop the various areas of the garden.
- Urgent need for water/irrigation to be provided/installed, possibly using run-off from buildings surrounding the garden.
- Need for interpretive signage for visitors.
- Soil depth profiles need to be taken around the garden.
- Temperature profile around garden.
- Additional horticulturist needed.
- Nursery facilities need attention.
- Interpretive boards and equipment needed.

Training needs for staff:

- Management of a botanic garden.
- Computerisation of collections.
- Record keeping of plants.
- Collecting techniques.

Remarks:

- Plan for layout of garden was developed by Mr Tom Müller (ex National Herbarium and Botanic Garden, Zimbabwe).
- The garden has a system of self-guided trails along paths with the most common plants identified by labels.
- No interpretive signage.
- Checklists of plants, birds, small mammals, reptiles and amphibians found in garden have been produced.
- Colour photographs of the garden taken from the air (helicopter) are available.
- Objectives have been set out for the garden.
- The land was donated to the Government of Namibia by the City Council of Windhoek in October 1969. It was proclaimed as a game reserve under Section 38 of the Nature
- Conservation Ordinance 31 of 1967 and earmarked to be developed as a Nature Garden. The garden was officially opened on 19 April 2000 by the Deputy Minister of Agriculture, Mr P. Smit.
- The development of the botanic garden is guided by a Steering Committee comprising members of both the Ministry of Environment and Tourism and the Ministry of Agriculture, Water and Rural Development.

Compilation date: 15 July 1998
Updated: July 2000

Figure 38. Hill slope dominated by Aloe littoralis, *National Botanic Garden, Namibia. (Photo: Christopher Willis)*

Figure 39. Recently constructed bridge, National Botanic Garden, Namibia. (Photo: Christopher Willis)

South Africa

Durban Botanic Gardens (Durban)

Name of botanic(al) garden: Durban Botanic Gardens
Postal address: P.O. Box 3740, Durban, 4000
Physical address: 70 St Thomas Road, Durban, 4001
Telephone: [27] 31/ 201 1303
Fax: [27] 31/ 201 7382
E-mail: dalzellc@prcsu.durban.gov.za
Director/Head of Institute: Errol Scarr
Curator and correspondent: Christopher G.M. Dalzell (Cell: 083 2720395)
Status: Municipal
Foundation date: 1849
Mission:

- To develop and curate conservation-significant collections of African cycads, palms and orchids.
- To maintain the existing assemblage of plants while promoting the flora of Africa.
- To cultivate regional and international links with the botanic gardens conservation community.
- To demonstrate the role plants can play in social upliftment by teaching organic gardening techniques.
- To awaken public appreciation of the gardens through environmental education.
- To maintain the gardens as a peaceful haven for visitors, and as one of Durban's heritage sites.

Size/area of garden: 14.5 ha
Landscaped area: 14.5 ha
Natural vegetation in garden: None
Latitude: 29°50'43"S
Longitude: 31°00'26"E
Altitude: Sea level
Rainfall: *ca* 1 700 mm per annum
Associated reserve: Not applicable
Number of paid staff: 39
Number of volunteers: 25
Number and names of horticulturists: 2
Barry Lang and Richard Symmonds
Number of labour staff: 31
Working hours/day: 8 hours (07h30–16h00)
Associated staff: Not applicable
Planting records: Paper-based; updating onto computer
Percentage indigenous plants: 30%
Threatened plants programme: *Stangeria eriopus*, Cycad Programme, Medicinal Plants
Indoor exhibition area: Orchid House
Friends: P.O. Box 3740, Durban, 4000
Seed bank: Yes
Index seminum: No
Research facilities: No
Research: Not applicable
Field gene banks or living collections: *Stangeria eriopus* project
In vitro *storage*: No, but have access to the Departmental Tissue Culture Laboratory
Pollen banks: Yes, cycads
DNA bank: No
Education programme:
Education section: Yes
Number of staff: One, and 18 volunteer guides
Courses for school children, students, adults: Yes
Courses on conservation: Yes
Environmental education: Yes
Public lectures: Yes
Permanent public displays: No
Special exhibitions: Yes
Public education/display building: Education Centre for 250 people, to be completed in November 2000. This will cater mostly for school children but will also be used for adult education courses on horticulture.
Issue booklets/leaflets: Yes
Guided tours: Yes, last Sunday of the month. Various theme tours.
Display labels: Yes
Special facilities for children: No, but planned for 2001.
Training courses: Yes
Horticulture
Gardening
Botany
Horticulture apprenticeship
Horticultural herbarium: No. Specimens held at NH and PRE.
Access to other herbarium: Natal Herbarium (NH)
Number of specimens: *ca* 1 000 specimens held on behalf of Durban Botanic Gardens by the Natal Herbarium.
Infrastructure/facilities:
Visitor centre: Yes

Nurseries: Yes
Greenhouses: Yes, 1 400 m²; one large shade house contains the orchids and bromeliads; a tunnel houses the palms and cycads; one enclosed house for orchids and seed germination.
Laboratories: No
Library: Yes
Auditorium: Being built—scheduled to be completed in November 2000
Exhibition area: Yes
Quarantine station: No
Bookshop: Yes
Arboretum: No
Equipment:
Vehicles: Yes
Lawnmowers: Yes
Irrigation: Yes
Others: None
Number of plant taxa in garden: *ca* 4 000
Plant families represented in garden: Unknown at this stage
Number of threatened plant species in garden: Unknown (cycads and palms)
Number of visitors per annum: *ca* 400 000
Computerisation of collections: In progress
Floras/vegetation types represented in garden: None
Database of collections: In progress
Open to public: 07h30–17h30, every day of the year
Entrance fee charged: No. Under investigation.
Publications: Yes. *The Conservatory* magazine, education publications, e.g. *Tree Notes of Durban Botanic Gardens, The Cycad Collection, Palms of Durban Botanic Gardens, New History of Durban Botanic Gardens*, and *Exotic Trees of Durban Botanic Gardens*
Assessment of needs:

- Durban Botanic Gardens need assistance with training of staff as well as employing a qualified education person. Some assistance with the audio-visual equipment would be one area where the garden needs some finances.

Remarks:

- Would like to see the Durban Botanic Gardens twinned with one of the National Botanical Institute's botanical gardens, such as the Lowveld National Botanical Garden in Nelspruit, South Africa.

Compilation date: 15 May 2000
Updated: 12 September 2000

Figure 40. View of Durban Botanic Gardens with the skyscape of Durban in the background. (Photo: Durban Botanic Gardens)

Figure 41. Orchids in full bloom inside the orchid house, Durban Botanic Gardens. (Photo: Durban Botanic Gardens)

Figure 42. View of cycad garden. The Durban Botanic Gardens contain 48 of the 64 recognised species of Encephalartos. *(Photo: Durban Botanic Gardens)*

Figure 43. View of the palm area, Durban Botanic Gardens. (Photo: Durban Botanic Gardens)

Free State National Botanical Garden (Bloemfontein)

Name of botanic(al) garden: Free State National Botanical Garden
Postal address: P.O. Box 29036, Danhof 9310, Bloemfontein, South Africa
Physical address: Rayton Road, off Dan Pienaar Drive, Bloemfontein, South Africa
Telephone: [27] 51/ 436 3530
or [27] 51/ 436 3612
Fax: [27] 51/ 436 4101
E-mail: fsnbg@mweb.co.za
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: Amadeus Mogale, b. 1970, N.D. Hort. (Poaceae, horticultural importance of grasses, medicinal plants of the Free State)
Status: Parastatal, National Botanical Institute
Foundation date: 1967
Mission: The Free State National Botanical Garden strives to become the pivot of knowledge, display, information, education and enjoyment of the flora of central South Africa.
Size/area of garden: 73.5 ha
Landscaped area: 6.7 ha
Natural vegetation in garden: 66.8 ha (Rhus, Stipagrostis, Eragrostis, Cussonia, succulent plants)
Latitude: 29°04'S
Longitude: 26°13'E
Altitude: 1 400 m a.s.l.
Rainfall: 200–1 200 mm per annum
Associated reserve: None
Number of paid staff: 25
Number of volunteers: None
Number and names of horticulturists: 2
- Shireen Harris, b. 1973 (succulents)
- Martin J. Lumley, b. 1936 (horticulture of indigenous plants, cultivation and propagation of indigenous bulbs)

Number of labour staff: 21
Working hours/day: 8 hours
Associated staff:
- P. Johan du Preez, b. 1960, [27] 51/ 401 3044, dupreezj@plk.nw.uovs.ca.za (vegetation science)

- Helen Kriel, b. 1935 (indigenous southern African plants)

Planting records: Computerised using Garden Records Database, developed by the Data Management section of the National Botanical Institute.
Percentage indigenous plants: 100%
Threatened plants programme: In progress
Indoor exhibition area: None
Friends: Botanical Society of South Africa (Bloemfontein Branch), P.O. Box 29036, Danhof, 9310. Contact: Martin Lumley, Tel. [27] 51/ 436 3530/436 3612, Fax: [27] 51/ 436 4101.
Seed bank: No
Index seminum: No
Research facilities: Yes, Research and Scientific Services, National Botanical Institute.
Research:
Horticulture
Propagation
Ecology
Conservation
Germination
Medicinal plants
Propagation of indigenous species
Field gene banks or living collections: Garden
In vitro *storage*: No
Pollen banks: No
DNA bank: No
Education programme: None
Education section: None
Number of staff: None
Courses for school children, students, adults: No
Courses on conservation: No
Environmental education: No
Public lectures: Yes
Permanent public displays: Yes
Special exhibitions: Yes
Public education/display building: Yes
Issue booklets/leaflets: Yes
Guided tours: Yes
Display labels: Yes
Special facilities for children: No
Training courses: Yes
Horticulture
Horticulture apprenticeship
Horticultural herbarium: Yes, Free State National Botanical Garden Herbarium (GOFS)
Number of specimens: *ca* 5 000
Access to other herbarium: National Herbarium (PRE), Pretoria
Number of specimens: *ca* 1 200 000
Infrastructure/facilities:
Visitor centre: No
Nurseries: Yes
Greenhouses: 2 (14.6 m x 8.7 m; 38 m x 12 m)
Laboratories: No
Library: Yes
Auditorium: No
Exhibition area: No
Quarantine station: No
Bookshop: No
Arboretum: No
Equipment:
Vehicles:
1 Isuzu KB Series
1 Massey Ferguson
1 Bedford
1 Mitsubishi Canter Bus
Lawnmowers:
1 Rotary 750
1 Estate Master EC17 Robin
1 Mirage D46 EC10 Robin-V

Figure 44. Erythrina zeyheri, *Free State National Botanical Garden. (Photo: Free State NBG)*

Figure 45. Rhus lancea, *Free State National Botanical Garden. (Photo: Free State NBG)*

Figure 46. 'Hartbeeshuis', Medicinal Demonstration Garden, Free State National Botanical Garden. (Photo: Christopher Willis)

Figure 47. View of the Bird Hide, Free State National Botanical Garden. (Photo: Christopher Willis)

Irrigation:
Automatic irrigation system in garden
Others:
Edge cutter Warrior EY15 Robin
2 Brush cutter Stihl FS280K
Number of plant taxa in garden: 100; no checklist available
Plant families represented in garden:
Acanthaceae
Aloaceae
Anacardiaceae
Asteraceae
Capparaceae
Combretaceae
Crassulaceae
Fabaceae
Lamiaceae
Poaceae
Scrophulariaceae
Vitaceae
Number of threatened plant species in garden: 3
Number of visitors per annum: 32 000
Computerisation of collections: Ongoing
Floras/vegetation types represented in garden: Nama Karoo, *Cymbopogon-Themeda* vegetation
Open to public: 08h00–18h00, Monday to Sunday
Entrance fee charged: Yes, R5.00 per adult, R2.00 per child/student with card, and R2.00 for pensioners.
Publications: Two Z-folder pamphlets
Assessment of needs:
- Develop the Plant Records System.
- Plan collecting trips.
- Have plant labels in the garden.
- Establish Visitor Interpretation Centre.
- Herbarium Assistant (on casual basis).
- Upgrade the glasshouse.

Remarks:
- Living Plant Collection Policy exists for the garden.
- A system of self-guided trails on the surrounding hills (kopjes) exists.
- The garden is known to be the bird-lover's paradise of the Free State.
- The garden boasts the largest living collection of *Rhus* (Anacardiaceae) species.

Compilation date: 15 October 1999
Updated: 12 July 2000

Harold Porter National Botanical Garden (Betty's Bay)

Name of botanic(al) garden: Harold Porter National Botanical Garden
Postal address: P.O. Box 35, Betty's Bay, 7141, South Africa
Physical address: Corner of Clarence Drive (R44) and Broadwith Road, Betty's Bay, Western Cape, South Africa
Telephone: [27] 28/ 272 9311
Fax: [27] 28/ 272 9333
E-mail: haroldpnbg@intekom.co.za
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: Cathrina (Karin) M. Behr, b. 1958, BSc (Botany and Zoology), BSc(Hons)(Plant Ecology)
Status: Parastatal, National Botanical Institute
Foundation date: 1950 (privately owned); 1959 (taken over by National Botanic Gardens of South Africa)
Mission: To provide the facilities, knowledge and expertise necessary to ensure the conservation, sustained use, appreciation and enjoyment of the exceptionally rich flora and vegetation found in the mountain and coastal fynbos of the southwestern Cape.
Size/area of garden: 200.5 ha
Landscaped area: *ca* 10 ha
Natural vegetation in garden: 190.5 ha. Coastal Fynbos, Coastal Dunes, Mountain Fynbos, Afromontane Forest relics in the kloofs.
Latitude: 34°21'S
Longitude: 18°56'E
Altitude: 15–360 m a.s.l.
Rainfall: 1 109 mm per annum
Associated reserve: The northern part of the natural area of the garden borders on the Kogelberg Nature Reserve and is included in the core area of the Kogelberg Biosphere Reserve. The rest of the garden is designated as a buffer area of this Biosphere Reserve. The southern boundary of the garden bounds on a municipal reserve area and so forms a continuum of protected area into the sea, with the Verwoerd Marine Reserve which extends two kilometres out to sea. Thus a protected area which includes the garden covers a whole river system from its origins in the mountains to the marine environment.
Number of paid staff: 18
Number of volunteers: 28. One volunteer helps almost every weekday curating the herbarium and identifying plants for staff and the public. She is also involved in developing poster displays, potting of plants and guiding visitors. Some volunteers act as guides in the garden and others help in the nursery with potting plants once a week.
Number and names of horticulturists: 1
Jane Allyson Forrester, b. 1952, N.D. Hort. (NTC 3)(landscaping)
Number of labour staff: 15, including foreman, driver and cleaning person; there is also one senior administrative clerk.
Working hours/day: 8 hours
Associated staff: National Botanical Institute colleagues at other NBI cost centres
Planting records: In progress. Due to previous lack of trained staff, time constraints, lack of computer facilities and devastating fires, adequate records were not kept. Due to above-mentioned problems, only the last five years records have been computerised. All new accessions will be computerised.
Percentage indigenous plants: 100%
Threatened plants programme: In progress. Plants closest to the garden will be dealt with first as these habitats are being threatened with development of the local townships. At a later stage, threatened plants from the rest of our designated collecting area will be dealt with.
Indoor exhibition area: The Fynbos Eco-Centre comprises two small inter-leading rooms for exhibition space. A small kitchen and a storeroom, as well as male and female toilets, form part of the Centre, though not purpose-built but adapted from an old disused building.
Friends: The garden is well supported by members of the Kogelberg Branch of the Botanical Society of South Africa, P.O. Box 93, Betty's Bay, 7141, South Africa. Various other members of the public support the garden in various ways.
Seed bank: No
Index seminum: When sufficient quantities

Figure 48. The entrance to the Harold Porter National Botanical Garden. (Photo: Karin Behr)

of index seed are available they are sent to Kirstenbosch National Botanical Garden for incorporation into their Index Seminum.

Research facilities: No

Research:

Propagation

Propagation of indigenous species

Field gene banks or living collections: Living collections in nursery and garden

In vitro *storage*: No

Pollen banks: No

DNA bank: No

Education programme: No formal programme, but provide walks, talks, demonstrations, slide shows and lectures as requested by schools, societies and other interested parties.

Education section: None

Number of staff: None. Use existing staff and volunteers.

Courses for school children, students, adults: Provide volunteer guide training from time to time.

Courses on conservation: None

Environmental education: Included as part of the above-mentioned education programme.

Public lectures: See above

Permanent public displays: Poster displays depicting various aspects of horticulture, botany and ecology, which are changed from time to time, are displayed in the Fynbos Eco-Centre. As the centre is used from time to time for staff training and various meetings, these displays are not always accessible to the public. The Useful Plants Garden is attached to the Fynbos Eco-Centre. Specimen flowers are displayed at the entrance throughout the year. Interpretive story boards are on display in various places in the garden.

Special exhibitions: A specimen Flower Show is held each spring to coincide with National Heritage Day.

Public education/display building: See notes above on Fynbos Eco-Centre.

Issue booklets/leaflets: Garden Z-fold brochure, bird list and various horticultural pamphlets and booklets available for a fee.

Guided tours: Trained volunteer guides or staff take tours if booked in advance

Display labels: Plant and interpretive labels and signs are placed in the garden but many

more are still required. Labels are produced at Head Office (based at the Kirstenbosch National Botanical Garden, Cape Town).

Special facilities for children: None

Training courses:

Horticulture: Practical training for horticultural students from time to time depending on the budget and accommodation constraints

Horticultural herbarium: Yes

Number of specimens: *ca* 2 000 (specimens are currently being entered into the herbarium database, but this process is far from complete)

Access to other herbarium: Yes. National Herbarium (PRE) and Compton Herbarium (NBG & SAM).

Number of specimens: PRE (*ca* 1 200 000); NBG & SAM (*ca* 500 000)

Infrastructure/facilities:

Visitor centre: No. The staffed entrance gate building serves as pay-point and information centre.

Nurseries: Nursery for accession and sales plants and a Plant Sales area

Greenhouses: One, in nursery, 60 m^2, for cuttings and seedlings

Laboratories: None

Library: Yes. Located in the Office Building

Auditorium: No

Exhibition area: Yes. See discussion on Fynbos Eco-Centre above.

Quarantine station: Not yet. Space has been allocated for one in the new nursery plans.

Bookshop: Yes, combined with Gift Shop—total of 9 m^2 floor space

Arboretum: No

Equipment:

Vehicles:

- 14-seater Toyota Hiace, 1995
- Toyota Hilux bakkie 2 litre diesel, 1999
- Toyota 3-ton Dyna truck, 1980
- Massey Fergusson 240 tractor, 1998
- Schus 1-ton trailer, *ca* 1984

Lawnmowers:

- Turfmaster 750 Lawnmower, 1993
- Professional lawnmower with Robin-EC10 engine, 1998
- Professional lawnmower with Robin-EC10 engine, 1999
- Gravely Custom Convertible lawnmower, 1986

Irrigation:

An ancient system exists which is supplied from the stream in Leopard's Kloof, but is not always reliable. Borehole supplied with electrical pump and the first phase of the reticulation system comprising buried mains pipes and irrigation points to which hoses can be attached. When funds become available the system will be expanded with secondary pipes, pop-up sprinklers in lawns and sprinklers in plant beds, all of which will be computerised.

Others:

- Ransome TM80 Aerifier
- Stihl FS 500 brushcutter
- Rolux edgetrimmer
- Stihl 026A VEQ chainsaw with drill bit attachment
- 600 litre Buffel Fire Fighter (fits on back of Toyota bakkie when needed), 1999
- Marshall-Fowler Steam Soil Conditioner ESC 60, 1998
- Various other workshop and gardening tools and equipment which adequately serve our purposes.
- A capital item list is available on request to authorized persons.

Number of plant taxa in garden: 190 genera, *ca* 508 species

Plant families represented in garden: 75. Main plant families represented in the garden include:

Asteraceae
Ericaceae
Fabaceae
Proteaceae
Restionaceae

Number of threatened plant species in garden: 25

Number of visitors per annum: *ca* 52 000

Computerisation of collections: In progress. Database programme developed by Trevor Arnold for the National Botanical Institute, South Africa. Computerisation not yet completed—there is still backlog to be worked through, assessed and checked for accuracy. No list therefore available.

Floras/vegetation types represented in garden: Coastal fynbos, local coastal dune vegetation, mountain fynbos and afromontane forest

Open to public: 08h00–18h00 every day

Entrance fee charged: Yes. R5.00 for adults, R2.00 for Senior Citizens (over 60 years), scholars and students (with cards). Free entry to card-carrying members of the Botanical Society of South Africa and pre-school children. Frequent visitors may obtain a special "Friends of the Garden" ticket which allows 30 entries at a cost of R60.00—this is clipped at the gate per each entry.
Publications: Z-fold brochure of the garden, bird list, various NBI pamphlets and booklets.
Assessment of needs:

- A second horticulturist is required. Extensive collecting, growing and landscaping programmes are required to bring the garden up to standard and these cannot be adequately met by one person.
- An assistant for the chief administrative clerk is required. The administrative load has increased radically. Her job includes typing of all the correspondence, reports and various other documents, stock lists, doing the accounts, petty cash, recording and control of income and expenditure, the banking, reception and telephonist duties, as well as personnel and financial administration. When she is on leave these duties are shared between the curator and horticulturist.
- An interpretive/education officer is required to fulfil the interpretation requirements of the garden (as most of our visitors are adults) and develop and run an education programme for the local schools in the area. This person would also do guide training and coordinate the non-horticultural volunteers.
- The nursery needs to be expanded and upgraded, with at least two more shade-houses and a covered seed sowing area. All the plant bays need to be concreted.
- The irrigation system needs to be completed. This includes a system for the nursery incorporating a good filtration system to cope with the water-borne phytophtera problem.
- The entrance building needs to be completely enclosed to protect visitors and staff from wind and rain.
- The restaurant is now far too small to cope with the volume of visitors and needs to be enlarged (kitchen, storage and seating) to seat at least 60 visitors (one bus load). In time a new building will be necessary to cope with a minimum of 160 guests instead of the 43 who can be seated presently. The present gift shop space is only 9 m^2 and too

Figure 49. View of the restaurant and patio at the Harold Porter National Botanical Garden. (Photo: Karin Behr)

small. If a new restaurant building should be built, the gift shop could be moved into the present restaurant space.
- A ride-on mower is required to cope with the large lawned areas and save precious man hours required at present to do the mowing with small machines.
- A good quality photocopier is required. The machine now in use gives constant maintenance problems.
- A new Y2K-compliant fax machine is required.
- The parking area needs to be enlarged and the whole area needs to be paved and landscaped to be more visitor friendly and attractive.
- More directional signage is needed.
- More interpretive story boards about the flora, fauna and ecology of the area need to be developed and placed in the garden.
- A large number of plant labels are urgently needed.
- As there is no public transport, quarters for horticultural students need to be built near the garden.
- Conservancy tanks need to be built for all the toilets as the garden is in a very high water table area.
- A general storeroom for tools and supplies and a proper workshop for the maintenance of tools, machinery and vehicles is required.
- Office space for additional staff mentioned above is required.

Training needs for staff:
- Better basic horticultural training for two nursery staff.
- A more intense social upliftment programme for 15 of the staff members that will help to instil a better work ethic and values.
- A job-related Customer Service training programme.
- A Human Resource Management programme is also required.

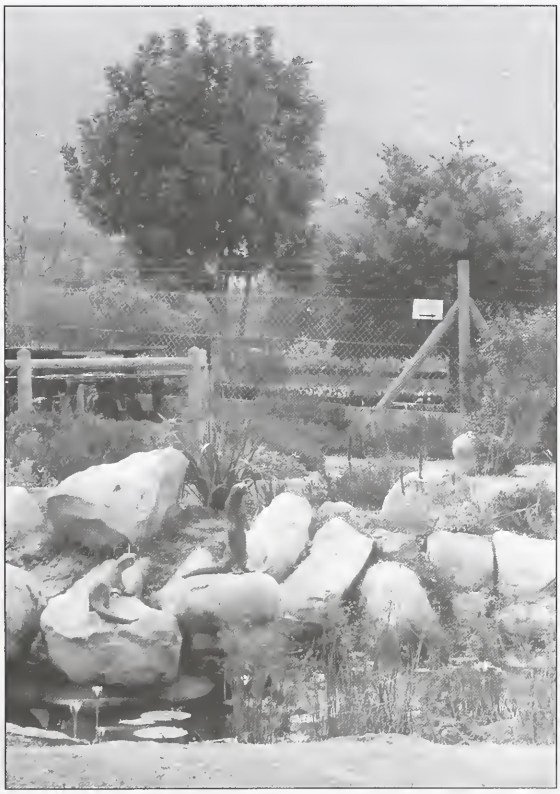

Figure 50. Bronze otters and ponds at the entrance, with the plant sales area in the background, Harold Porter National Botanical Garden. (Photo: Karin Behr)

Remarks:

- The garden is situated in a beautiful setting on a well-known tourist route, which incorporates the Whale Route.
- Visitor facilities include parking area, entrance gate with pay-point, information and flower specimen exhibit, toilets, restaurant, book and gift shop, plant sales and two wheelchairs for disabled visitors. The Fynbos Eco-Centre and Useful Plants Garden provide additional interest.
- A circular route has been developed in the garden, which is suitable for wheelchair and pram users. A trail to the Disa Kloof waterfall with *Disa uniflora* in its natural habitat (flowering in December and January) is also accessible to these visitors.
- Other trails of various lengths lead into the natural areas of the garden.
- Interpretive signage makes for an interesting visitor experience.
- The garden falls into the Kogelberg Biosphere Reserve with the upper natural part forming part of the core area while the rest of the garden is part of the designated buffer zone of this reserve.
- The garden contains a whole river system within its boundaries.

Compilation date: 8 September 1999
Updated: 30 June 2000

Figure 51. Part of the nursery and office block at the Harold Porter National Botanical Garden. (Photo: Karin Behr)

Karoo Desert National Botanical Garden (Worcester)

Name of botanical garden: Karoo Desert National Botanical Garden
Postal address: P.O. Box 152, Worcester, 6849, South Africa
Physical address: Roux Road, Panorama, Worcester, South Africa
Telephone: [27] 23/ 347 0785
Fax: [27] 23/ 342 8719
E-mail:karroid@intekom.co.za
or olivers@intekom.co.za
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: Mr Ian B. Oliver, b. 1955, olivers@intekom.co.za
Status: Parastatal, National Botanical Institute
Foundation date: 1921
Mission: To cultivate, display, promote South Africa's arid flora as well as the flora of southern Namibia.
Size/area of garden: 154 ha
Landscaped area: 11 ha
Natural vegetation in garden: 143 ha
Latitude: 33°36'S
Longitude: 19°28'E
Altitude: 300–525 m a.s.l.
Rainfall: 250 mm per annum
Associated reserve: None
Number of paid staff: 26
Number of volunteers: One (permanent) and up to 12 volunteers per annum
Number and names of horticulturists: 2
Deon M. Viljoen, N.D. Hort.
Werner Voight, N.D. Hort.
Number of labour staff: 17
Working hours/day: 8 hours
Associated staff: None
Planting records: *ca* 9 000 records thus far computerised
Percentage indigenous plants: 99%
Threatened plants programme: Collection of certain Red Data species, *ca* 350 taxa in total
Indoor exhibition area: No (but would have if funds were available)
Friends: Kirstenbosch Branch of the Botanical Society of South Africa
Seed bank: Yes
Index seminum: Yes. Available on request.
Research facilities: Yes. Kirstenbosch Research Centre and other *bona fide* researchers.

Figure 52. Collection of Haworthia *species in the Index nursery, Karoo Desert National Botanical Garden. (Photo: Christopher Willis)*

Research:
Horticulture
Taxonomy
Breeding
Propagation
Conservation
Germination
Medicinal plants
Propagation of indigenous species
Field gene banks or living collections: Yes. Garden and Index collections.
In vitro *storage*: No
Pollen banks: No
DNA bank: No
Education programme: Yes
Education section: Use own garden staff on an ad hoc basis
Number of staff: Own staff on an ad hoc basis
Courses for school children, students, adults: International tourists in the form of guided tours
Courses on conservation: Yes, school children
Environmental education: Yes, school children
Public lectures: Yes, in the garden as well as at the University of Cape Town (summer and winter schools)
Permanent public displays: Karroid phytogeographic beds
Special exhibitions: Poster displays in lecture hall
Public education/display building: No
Issue booklets/leaflets: Yes, one outdated Z-fold brochure
Guided tours: Yes, in situ and ex situ
Display labels: Yes, computer-generated anodized aluminium
Special facilities for children: Slide show, walks in the garden on environmental education
Training courses: Yes, through the University of Cape Town
Horticulture: Yes, "How to grow succulents"
Horticulture apprenticeship: Yes; six months practical training
Horticultural herbarium: Yes; Karoo Desert National Botanical Garden Herbarium (GKAR)
Number of specimens: 1 000 (Worcester environment only)
Access to other herbarium: Compton Herbarium (NBG & SAM), Kirstenbosch, Cape Town
Number of specimens: 500 000
Infrastructure/facilities:
Visitor centre: No
Nurseries: 3; Index Collection, Plant Sales and Production Nursery
Greenhouses/shade houses: 7; total area of 2 200 m^2
Laboratories: Yes, 45 m^2
Library: Yes
Auditorium/lecture hall: Yes, 72 m^2
Exhibition area: No
Quarantine station: Yes, a sterilisation area
Bookshop: Yes, 16 m^2
Arboretum: None
Equipment:
Vehicles:
26-seater Canter Bus
LWB Toyota
Nissan 1400 LDV
Massey Ferguson
Tractor and one trailer
Lawnmowers: 2
Irrigation: Yes. 16-station automatic Rain Bird System; 20-station manual Rain Bird System; use of taps and hose pipes
Others: Not applicable
Number of plant taxa in garden: 416 indigenous species growing naturally
Plant species/taxa represented in garden: 4 200 (including collections)
Number of threatened plant species in garden/ Index Nursery: 350
Number of visitors per annum: 30 000
Computerisation of collections: Yes
Floras/vegetation types represented in garden: Worcester/Robertson area flora
Open to public: Yes, every day 07h00–18h00
Entrance fee charged: Yes, R8 for adults and R4 for children (only from August till end October)
Publications: *NBI News*, the National Botanical Institute's corporate newsletter
Assessment of needs:

- Funding should be made available for the training of student horticulturists. This is for their six-month practical.
- Funding is needed for a lath covering to protect the geophyte collection in the Index Nursery from the hot summer sun. These bulbs are a valuable national collection.

Figure 53. A traditional cooking shelter or 'kookskerm', built by Namaqualanders according to a long regional tradition of indigenous architecture, Karoo Desert National Botanical Garden. A framework made from the branches of Rhus pendulina *and* Acacia karroo *is covered with reed mats made from* Cyperus marginatus *and* Scirpus *and* Juncus *species. The 1.5 m high barrier around the shelter and cooking area is made of brushwood harvested from species of* Ruschia *and* Stoeberia *or* Euphorbia mauritanica. *(Photo: Christopher Willis)*

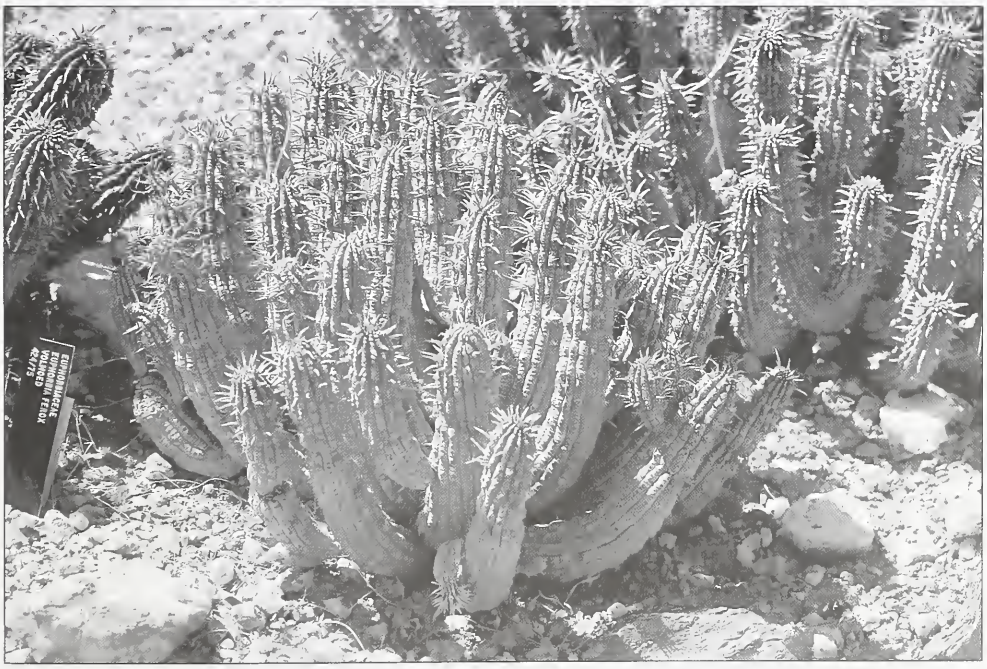

Figure 54. Euphorbia ferox *(Euphorbiaceae) in the Great Karoo bed, Karoo Desert National Botanical Garden. (Photo: Christopher Willis)*

- Funding is needed for a covered soil storage area.
- Funding is needed for a laptop computer to aid with accessioning plants in the field. A good second-hand machine would suffice. This laptop would, obviously, have a multi-tude of other uses.
- A partially covered area for the display of smaller succulents and bulb species. The main reason for this is not only an aesthetic one, but also an educational one.

Remarks:

- The Karoo Desert National Botanical Garden (NBG) is one of five recognised international succulent gardens.
- The garden is at the moment the only truly succulent garden in the southern hemisphere and on the African continent. This could change with the development of Namibia's National Botanic Garden in Windhoek.
- An excellent collection of winter-rainfall geophytes is housed in the garden.
- A well-stocked plant sales area sells plants to the general public and other interested parties. Over 600 taxa are offered for sale.
- Six kilometres of walks/hiking trails in the natural hilly areas are open to visitors.
- The garden is well known for its colourful springs and winters.

Compilation date: 9 September 1999
Updated: 26 August 2000

Figure 55. Natural vegetation along the Shale trail, Karoo Desert National Botanical Garden. The Brandwacht Mountains can be seen in the background. (Photo: M.J. Wells)

Kirstenbosch National Botanical Garden (Cape Town)

Name of botanic(al) garden: Kirstenbosch National Botanical Garden
Postal address: Private Bag X7, Claremont, 7735, South Africa
Physical address: Rhodes Drive, Claremont, Cape Town
Telephone: [27] 21/ 762 9120
Fax: [27] 21/ 797 6570
E-mail: lerouxp@nbict.nbi.ac.za
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: Philip le Roux, b. 1955, H.N.D (Parks and Recreation) (Management of natural areas)
Status: Parastatal, National Botanical Institute
Foundation date: 1913
Mission: To establish, develop and maintain dynamic collections of southern African plants
Size/area of garden: 528 ha
Landscaped area: 38 ha
Natural vegetation in garden: *ca* 470 ha: Fynbos, Afromontane Forest
Latitude: 33°59'S
Longitude: 18°26'E
Altitude: 100–1 086 m a.s.l.
Rainfall: 1 440 mm per annum
Associated reserves: Darling Flora Reserve (Darling), Edith Stevens Reserve (Mitchell's Plain)
Number of paid staff: 145
Number of volunteers: 100–200
Number and names of horticulturists: 15

- Craig Breedt, b. 1966, N.D. (Forestry), Estate Manager (Vacant)
- Hildegard Crous, b. 1966, N.D. Hort., Horticulturist (Vacant)

Figure 56. Spring daisies next to the main lawn, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones)

Figure 57. The fragrance garden, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones)

- Graham Duncan, b. 1959, N.D. Hort., Horticulturist (Bulbs)
- Anthony Hitchcock, b. 1960, N.D. Hort., Horticulturist (Nursery manager)
- Hanneke Jamieson, b. 1941, N.D. (Parks and Recreation), Horticulturist (Proteas and Restios)
- Roger Jaques, b. 1969, BSc, Horticulturist (Ball Agreement)
- Norma Jodamus, b. 1974, N.D. Hort., Horticulturist (Alpines and Buchus)
- Ebrahim Lawrence, b. 1967, N.D. Hort., Horticulturist (Pelargoniums and Ferns)
- Philip le Roux, b. 1955, N.D. (Forestry), N.D. Hort., N.D. (Parks and Recreation), Curator
- Alice Notten, b. 1966, BSc, N.D. Hort., Horticulturist (Seeds)
- Fiona Powrie, b. 1959, N.D. Hort., BSc(Hons), Nursery Manager (Vacant)
- Antonia Shaide, b. 1974, N.D. Hort., Horticulturist (Outreach)
- James Townsend, b. 1969, N.D. Hort., Horticulturist (Vacant)
- Liesl van der Walt, b. 1967, N.D. Hort., Horticulturist (Annual and Perennial Display)
- Ernst J. van Jaarsveld, b. 1953, N.D. Hort., MSc, Horticulturist (Succulents)

Number of labour staff: 128
Working hours/day: 8 hours
Associated staff: NBI education, research, marketing, administration
Planting records: Computerised
Percentage indigenous plants: 99.9%
Threatened plants programme: Being developed
Indoor exhibition area: Display glasshouse (Botanical Society Conservatory)
Friends: Kirstenbosch Branch of the Botanical Society of South Africa, P.O.Box 195, Newlands 7725, South Africa
Seed bank: No
Index seminum: No; Annual Seed Catalogue produced.
Research facilities: NBI Research
Research: (excluding NBI research options) Horticulture

Breeding
Propagation
Conservation
Germination
Tissue culture
Propagation of indigenous species
Field gene banks or living collections: Yes, garden and nursery
In vitro *storage*: No
Pollen banks: No, only short-term for Orchidaceae and *Encephalartos*
DNA bank: No
Education programme:
Education section: Yes
Number of staff: 5
Courses for school children, students, adults: Yes
Courses on conservation: No
Environmental education: Yes
Public lectures: Yes
Permanent public displays: Yes
Special exhibitions: Yes
Public education/display building: No
Issue booklets/leaflets: Yes, garden guides, information notes, propagation and cultivation notes
Guided tours: Yes, general and specialist
Display labels: Yes, central NBI label department
Special facilities for children: No
Training courses:
Horticulture apprenticeship
Horticultural herbarium: No
Number of specimens: Not applicable
Access to other herbarium: Compton Herbarium (NBG & SAM)
Number of specimens: *ca* 500 000
Infrastructure/facilities:
Visitor centre: Yes
Nurseries: 2
Greenhouses: 27, covering approximately 3 200 m^2
Laboratories: 1, tissue culture
Library: Access to NBI Molteno Library

Figure 58. Mesems provide a riot of colour in October, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones)

Auditorium: Yes
Exhibition area: Yes
Quarantine station: No
Bookshop: Yes
Arboretum: Inside garden
Equipment:
Vehicles:
1 4x4 Mercedes truck
2 60-seater Mercedes buses
2 Toyota Hi Aces
1 4x4 Toyota pickup
1 2200 Toyota pickup
1 1600 Nissan pickup
4 Massey Ferguson tractors and trailers
1 John Deere 4x4 tractor and trailer
1 front end loader
2 4x4 dumpers
1 agricar
2 golf cars
Lawnmowers:
- 3 tractor drawn, Ransome 3 cylinder mowers
- 2 Gravely mowers
- 3 Rotary Warrior Robin
- 1 tractor-drawn bush cutter, POWA CUTTA PC1.2m

Irrigation: Automated irrigation
Others:
1 sod cutter, RYAN JR
1 tractor mounted chipper, Jensen A425
2 rotavator, GEM
8 Stihl chainsaws
7 brushcutters
1 Stihl soil auger
1 fertiliser spreader
1 plate compactor and brick roller
5 Stihl leaf blowers
Wheelbarrows
Small tools
Equipped work shop
Air compressor
Number of plant taxa in garden: 5 000
Plant families represented in garden: 187
Number of threatened plant species in garden: 156
Number of visitors per annum: 680 000
Computerisation of collections: Yes, in-house program using DataEase to be converted to MS Access
Floras/vegetation types represented in garden: Flora of southern Africa
Open to public: 08h00–19h00 (summer); 08h00–18h00 (winter)
Entrance fee charged: Yes, R10 for adults, R5 for children (scheduled to be increased to R15/R5 in November 2000)
Publications: See booklets/leaflets
Assessment of needs:
- Need to complete master plan for garden.
- Computerised mapping needs to be completed.
- Functional flow pattern through the garden needs to be established by creating linked routes.
- Urgent need to update plant records database.
- Nursery needs to be reconstructed, process has started.
- Old sections of the garden need to be redeveloped.
- Paving materials need to be standardised.
- Horticultural Hub (Home Gardeners Centre) needs to be developed.
- Additional parking facilities required.
- Replacement of old equipment.

Remarks:
- Living collections need constant re-assessment to ensure they are not stagnating.
- Constant updating required of databases, garden maps, master plan, signage.
- Being an old garden the problem of needing to re-develop areas, in the face of public resistance to change, needs to be sensitively handled.
- A system to replace dated equipment needs to be implemented.
- Though the garden is large, well developed and has an adequate infrastructure, it is important to remember that a garden is never finished and is in a constant state of flux. To maintain standards, constant inputs and redevelopments are required.

Compilation date: 16 September 1999
Updated: 14 September 2000

Figure 59. Looking down towards the Dell, Kirstenbosch National Botanical Garden. (Photo: Colin Paterson-Jones)

Lowveld National Botanical Garden (Nelspruit)

Name of botanic(al) garden: Lowveld National Botanical Garden
Postal address: P.O. Box 1024, Nelspruit, 1200, South Africa
Physical address: Off White River Road, Nelspruit
Telephone: [27] 13/ 7525531
Fax: [27] 13/ 7526216
E-mail: glow@iafrica.com
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: R.M. (Rudi) Britz, b. 1943, Diploma in Forestry (trees and dry bushveld in general, management, public relations and administration)

Status: Parastatal, National Botanical Institute
Foundation date: 1970
Mission: To excel in growing, displaying and conserving living plant collections of the lowland areas of southern Africa with a special emphasis on trees, cycads and ecological areas.
Size/area of garden: 159 ha
Landscaped area: 25 ha
Natural vegetation in garden: 134 ha, intermediate between Mixed Lowveld Bushveld and Sour Lowveld Bushveld. Geology is mainly granite with dolerite intrusions. Main trees: *Combretum collinum, Sclerocarya birrea, Lannea stuhlmannii, Peltophorum africanum, Terminalia sericea, Pterocarpus angolensis*. Main grasses: *Hyperthelia dissoluta, Heteropogon contortus, Hyparrhenia hirta* and *Setaria sphacelata*.
Latitude: 25°27'S

Longitude: 30°29'E
Altitude: 640 m a.s.l.
Rainfall: 750 mm per annum
Associated reserve: None
Number of paid staff: 42
Number of volunteers: 7 garden guides
Number and names of horticulturists: 2

- W.C.F. (Willem) Froneman, b. 1955, N.D. (Nature Conservation), N.D. (Parks and Recreation), NTS III (Garden maintenance, commercial nursery, special interest in Acanthaceae and *Clivia* spp.)
- P.J.H. (Johan) Hurter, b. 1963, BSc(Hons) (Taxonomy of *Encephalartos* and African *Syzygium* spp., index nursery, development of taxonomic and ecological thematic garden areas, ex situ cycad conservation, training of conservation law enforcement officers, plant identifications, curator of collections, herbarium curation, plant accessions, database and computerisation), glow@iafrica.com

Number of labour staff: 38
Working hours/day: 8 hours
Associated staff: None
Planting records: Paper and computer based, follows NBI PRECIS database. No plant checklist currently available. Checklists avail-

Figure 60. A magnificent specimen of Raphia australis, *Lowveld National Botanical Garden. (Photo: Rudi Britz)*

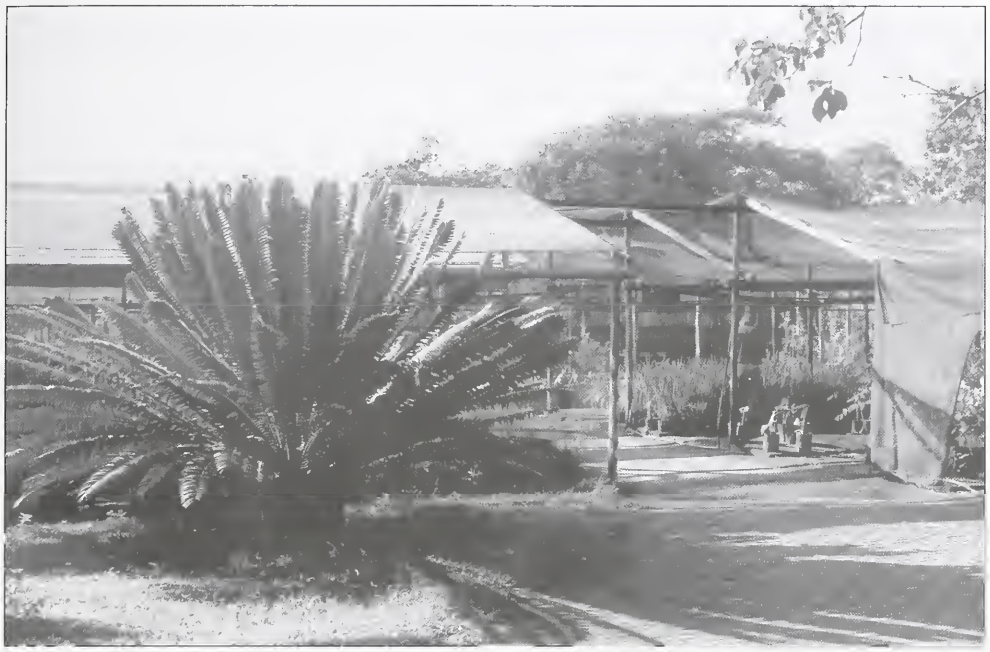

Figure 61. Nursery facilities with Encephalartos transvenosus *in the foreground. (Photo: Rudi Britz)*

able for mammals, birds, reptiles, butterflies and some trees.
Percentage indigenous plants: 99%
Threatened plants programme: Population-based *ex situ* conservation of *Encephalartos* sp. in gene banks of between 50 and 100 plants.
Indoor exhibition area: None
Friends: Lowveld Branch of the Botanical Society of South Africa; Friends of the Lowveld National Botanical Garden
Seed bank: No
Index seminum: No
Research facilities: No
Research:
Horticulture
Taxonomy
Breeding
Propagation
Ecology
Conservation
Germination
Propagation of indigenous species
Reproductive biology
Field gene banks or living collections: Garden and cycad gene banks
In vitro *storage*: None
Pollen banks: Pollen of *Clivia* species and cycads stored in a fridge for later use and supplies.
DNA bank: None
Education programme: Guided tours available by appointment
Training courses: Yes
Botany: Threatened plant identification courses for conservation officers
Horticulture apprenticeship: In-service student training
Horticultural herbarium: Lowveld National Botanical Garden Herbarium (GLOW)
Number of specimens: *ca* 7 000
Access to other herbarium: None
Number of specimens: Not applicable
Infrastructure/facilities:
Visitor centre: None
Nurseries: 2
Greenhouses: 11 propagation structures (4 700 m^2)
Laboratories: None
Library: Yes, dedicated to garden and general botany
Auditorium: None
Exhibition area: None
Quarantine station: None
Bookshop: None

Figure 62. The Nelspruit Cascades, Lowveld National Botanical Garden. (Photo: Rudi Britz)

Arboretum: None
Equipment:
Vehicles:
- 1 Light Delivery Vehicle (Isuzu Kb230 diesel)
- 1 Mercedes Benz 1113 truck
- 1 Massey Ferguson tractor
- 1 John Deere front end loader

Lawnmowers:
- 1 LX172 John Deere ride-on
- 1 Mirage ride-on
- 2 Estate Masters
- 1 Mirage

Irrigation:
Four overhead water cannons in rainforest; drag-line and pop-up irrigation in rest of garden.

Others:
- 1 Scotts trailer
- 1 AgriCar nursery transport vehicle

Number of plant taxa in garden: 2 054+
Plant families represented in garden: 114
Number of threatened plant species in garden: 120
Number of visitors per annum: 68 000
Computerisation of collections: Yes, current since 1985. Pre-1998 records being manually converted from DataEase to new database installed in 1998. Based on PRECIS and developed by the NBI. Software: Microsoft Access. Person responsible for database: Johan Hurter. Three copies stored at different places.
Floras/vegetation types represented in garden: Rain Forest, Afromontane Forest, Sand Forest, *Androstachys johnsonii* forest, Coastal Forest, Mopane Bushveld, Soutpansberg Arid Mountain Bushveld, Lebombo Arid Mountain Bushveld, Mixed Lowveld Bushveld, Sour Lowveld Bushveld, central and east African Miombo
Open to public: 08h00–18h00 (summer); 08h00–17h15 (winter)
Entrance fee charged: Yes; adults R5, children and pensioners R2
Publications: None
Assessment of needs:
- Upgrade parking area (too small).
- Upgrade entrance area to include an interpretation/information area, book shop and plant sales nursery.
- Upgrade of currently dangerous bridge on access road over Crocodile River.
- Lecture room and meeting area for societies.
- Environmental education officer is required to develop and run an environmental education programme.

- An education centre needs to be developed.
- At least one more horticulturist must be employed.
- One additional vehicle for field work (4x4) needs to be purchased.
- Complete estate (approximately 4 km) needs to be fenced.
- Viewpoint overlooking the Nelspruit Cascades needs upgrading.
- Thatch on building roofs needs maintenance.
- Lawnmowers need to be replaced urgently.
- Signage to and in the garden needs to be improved.
- Labels for index plants in the garden are required.
- Invader plants in and surrounding the garden must be controlled.

Remarks:

- Collecting trips to southern African rain forest areas must be undertaken so as to complete development of the African Rain Forest area—the area is currently stagnating due to a shortage of plant material.
- Current plans to develop the northern bank of the Crocodile River will lead to a further demand in staffing and equipment: at least one more horticulturist and five labourers will have to be employed.
- Cycad seed cannot be stored using cryotechnology. A living collection based on wild cycad populations was therefore started at the Lowveld National Botanical Garden. These cycad gene banks serve as an *ex situ* conservation backup for many of South Africa's endangered cycad taxa.
- The well-documented plant collections of the Lowveld National Botanical Garden are frequently used by *bona fide* researchers from other institutions, who would otherwise have to travel far and wide to obtain material for projects. The highly valued and large Combretaceae collection is currently

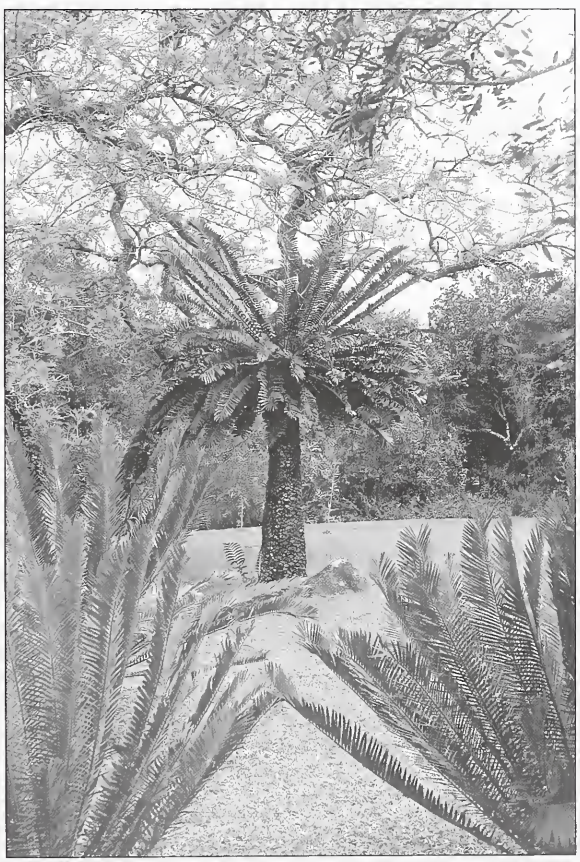

Figure 63. Part of the large cycad collection, Lowveld National Botanical Garden. (Photo: Rudi Britz)

being used by Prof. J.N. Eloff in his research for anti- cancer phytocompounds in the family. Many other collections, such as the Rutaceae tree collection, assist agricultural researchers from INFRUTEC and the ARC in their research on crop plant pests, their hosts and vectors.

- The recent population explosion and subsequent agricultural pressures on the natural vegetation in the Lowveld area of Mpumalanga for the production of monoculture sugar cane has increased the need for garden staff to have access to a four-wheel drive vehicle.This is highlighted by the recent discovery of several new plant taxa and new distribution records for South Africa in areas earmarked for agricultural development. Garden staff are currently using four-wheel drive vehicles of third parties. Many of the areas are inaccessible by conventional vehicle. Once clearing of the natural vegetation has commenced there is a subsequent reciprocal loss of plant taxa. Several of the grid areas are completely under- collected and the recent discovery of plant taxa of the endangered Maputaland Centre of Endemism has shown that the Onderberg region of the Mpumalanga Province is a hot spot on the generic level in South Africa. Several grid regions have now suffered an 80% loss of natural vegetation due to agricultural expansion in the past ten years. The completion of the Magugu Dam in Swaziland in the next five years will accelerate the agricultural expansion. A unique part of South Africa's flora will be going "quietly in the night" (literally) without any record as to it ever having been there. A four-wheel drive vehicle will assist tremendously in the rescue of now threatened plant taxa, as well as the documentation of the flora. The Lowveld National Botanical Garden is currently the only scientific institution in Mpumalanga that has the will, staff and resources for plant rescue and survey in the province.

Compilation date: 8 September 1999
Updated: 14 July 2000

Natal National Botanical Garden (Pietermaritzburg)

Name of botanic(al) garden: Natal National Botanical Garden
Postal address: Natal National Botanical Garden, P.O Box 21667, Mayor's Walk, 3208, KwaZulu-Natal Province, South Africa
Physical address: Natal National Botanical Garden, Mayor's Walk, Pietermaritzburg
Telephone: [27] 33/ 344 3585
Fax: [27] 33/ 344 1284
E-mail: gnat@futurenet.co.za
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: Brian B. Tarr, b. 1946, Diploma in Adult Education, N.D. Hort. (*Ex situ Clivia* conservation, *Dierama*, *Rhodohypoxis*)
Status: Parastatal, National Botanical Institute
Foundation date: 1874
Mission: To excel in growing, displaying and conserving living plant collections of the Grasslands of the East Coast region of southern Africa for horticultural, educational and scientific purposes.
Size/area of garden: 52 ha
Landscaped area: 12 ha
Natural vegetation in garden: 40 ha. Mostly 'Ngongoni Veld, with dominant *Trimeria grandiflora, Combretum kraussii, Halleria lucida, Themeda triandra, Aristida junciformis*.
Latitude: 26°36'S
Longitude: 30°21'E
Altitude: 700 m a.s.l.

Rainfall: 900 mm per annum
Associated reserve: Not applicable
Number of paid staff: 28
Number of volunteers: None
Number and names of horticulturists: 2
- Brian B. Tarr, b. 1946, Diploma in Adult Education, N.D. Hort. (*Ex situ Clivia* conservation, *Dierama, Rhodohypoxis*)
- S. Nonjinga, b. 1957, N.D. Hort. (*Clivia*, muthi plants)

Number of labour staff: 23
Working hours/day: 8
Associated staff: None
Planting records: Computer and paper
Percentage indigenous plants: 75%
Threatened plants programme: Yes
Indoor exhibition area: Not applicable
Friends: Not applicable
Seed bank: No
Index seminum: No
Research facilities: Natal Herbarium
Research:
Horticulture
Propagation
Conservation
Germination
Propagation of indigenous species

Field gene banks or living collections: Yes
In vitro *storage*: No
Pollen banks: No
DNA bank: No
Education programme:
Education section: Yes
Number of staff: 1 (John Roff, b. 1966, Interpretive Officer)
Courses for school children, students, adults: Yes
Courses on conservation: No
Environmental education: Yes
Public lectures: Yes
Permanent public displays: Yes
Special exhibitions: Yes (Sensory Garden)
Public education/display building: No
Issue booklets/leaflets: Yes
Guided tours: Yes
Display labels: Yes
Special facilities for children: Yes
Training courses: Can offer training in interpretation and plant propagation
Horticulture
Gardening
Horticulture students
Horticultural herbarium: No
Number of specimens: Not relevant

Figure 64. Duck pond near the restaurant, Natal National Botanical Garden. (Photo: M.J. Wells)

Figure 65. London Plane Tree (Platanus acerifolia) *Avenue, Natal National Botanical Garden. (Photo: Natal NBG)*

Access to other herbarium: University of Natal, Pietermartizburg Herbarium (NU), Natal Herbarium, Durban (NH)
Number of specimens: 120 000 (NU); 100 000 (NH)
Infrastructure/facilities:
Visitor centre: No
Nurseries: 1
Greenhouses: Two propagation structures (504 m^2) and a tunnel (210 m^2)
Laboratories: None
Library: Small reference library
Auditorium: No
Exhibition area: No
Quarantine station: No
Bookshop: No
Arboretum: No
Equipment:
Vehicles: Light duty vehicle, two tractors and trailers
Lawnmowers: 4
Irrigation: Yes
Others: Brushcutters, chainsaws, pumps
Number of plant taxa in garden: *ca* 1 500
Plant families represented in garden: Main families are Amaryllidaceae, Asteraceae, Iridaceae and Poaceae
Number of threatened plant species in garden: 35 (including *Kniphofia pauciflora* (Ex), *K. leucocephala* (E), *K. latifolia* (E), *Dierama erectum* (E), *D. nixonianum* (R), *Aloe prinslooi* (R); Exotics: *Camellia crapnelliana* and *Aloe suzannae*)
Number of visitors per annum: 60 000
Computerisation of collections: In process
Floras/vegetation types represented in garden: 'Ngongoni Veld
Open to public: 08h00–18h00 (summer); 08h00–17h30 (winter); 7 days per week
Entrance fee charged: Yes; adults R5, children R2
Publications: None
Assessment of needs:
- Education staff
- Storage facilities for garden
- Offices required for plant recording, administration and curator
- Entrance building, gift shop and car park

Remarks: Garden is in transition from an Eurocentric garden to an African Botanical Garden. The garden is 126 years old.
Compilation date: 18 August 1999
Updated: 5 September 2000

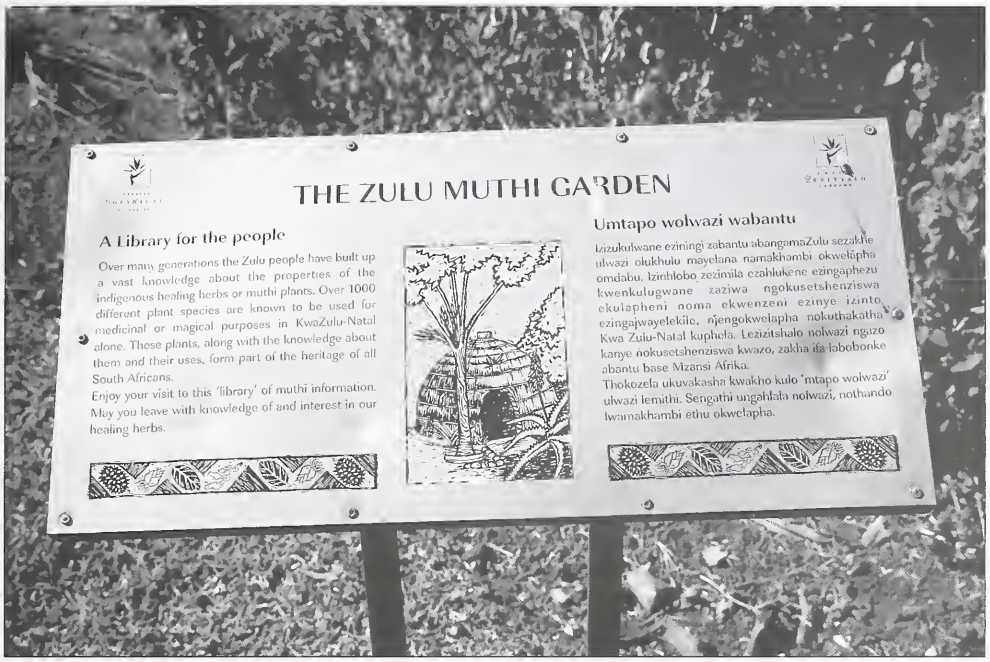
THE ZULU MUTHI GARDEN
A Library for the people
Over many generations the Zulu people have built up a vast knowledge about the properties of the indigenous healing herbs or muthi plants. Over 1000 different plant species are known to be used for medicinal or magical purposes in KwaZulu-Natal alone. These plants, along with the knowledge about them and their uses, form part of the heritage of all South Africans.
Enjoy your visit to this 'library' of muthi information. May you leave with knowledge of and interest in our healing herbs.
Umtapo wolwazi wabantu
Izizukulwane eziningi zabantu abangamaZulu sezakhe ulwazi olukhulu mayelana namakhambi okwelapha omdabu. Izinhlobo zezimila ezahlukene ezingaphezu kwenkulugwane zaziwa ngokusetshenziswa ekulapheni noma ekwenzeni ezinye izinto ezingajwayelekile. Njengokwelapha nokuthakatha Kwa Zulu-Natal kuphela. Lezizitshalo nolwazi ngazo kanye nokusetshenziswa kwazo, zakha ifa laboboke abantu base Mzansi Afrika.
Thokozela ukuvakasha kwakho kulo 'mtapo wolwazi' ulwazi lemithi. Sengathi ungahlala nolwazi, nothando lwamakhambi ethu okwelapha.

Figure 66. Interpretive signage at the Zulu Muthi Garden, Natal National Botanical Garden. (Photo: Pitta Joffe)

Figure 67. Traditional hut used as an interpretive centre, Natal National Botanical Garden. (Photo: Pitta Joffe)

Pretoria National Botanical Garden (Pretoria)

Name of botanic(al) garden: Pretoria National Botanical Garden
Postal address: Private Bag X101, Pretoria 0001, South Africa
Physical address: 2 Cussonia Avenue, Brummeria, Pretoria 0001, South Africa
Telephone: [27] 12/ 804 3166
or [27] 12/ 804 3149
Fax: [27] 12/ 804 6200
E-mail:garden@nbipre.nbi.ac.za/
hans@nbipre.nbi.ac.za
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: Hans Heilgendorff
Status: Parastatal, National Botanical Institute
Foundation date: 1946
Mission: Through aesthetic displays, the Pretoria NBG cultivates and promotes extensive existing collections, as well as the flora of the African Savannah and Afromontane forests, best suited to the climate of Pretoria. This is supported by active research, education and information programmes.
Size/area of garden: 76 ha
Landscaped area: 50 ha
Natural vegetation in garden: 16 ha (dominant vegetation is Bankenveld veld-type); dominant plant taxa: *Ochna pulchra, Strychnos spinosa, Englerophytum magalismontanum*
Latitude: 25.44.299 S

Figure 68. Pretoria Portland Cement (PPC)-sponsored artificial waterfall, Pretoria National Botanical Garden. (Photo: Christopher Willis)

Longitude: 28.16.853 E
Altitude: 1 360 m a.s.l.
Rainfall: 750 mm per annum
Associated reserve: None
Number of paid staff: 81
Number of volunteers: Variable
Number and names of horticulturists: 4
Garden management: Nick Klapwijk
Living collections: Priscilla Swartz
Propagation: Antoinette Eyssell
Estate management: Clinton Law
Number of labour staff: 73
Working hours/day: 8 hours (40-hour week)
Associated staff: None
Planting records: Currently paper based—in the process of computerising
Percentage indigenous plants: 98% (2% from Madagascar)
Threatened plants programme: *Encephalartos* species
Indoor exhibition area: None
Friends: Botanical Society (Pretoria Branch), Private Bag X101, Pretoria 0001
Seed bank: No
Index seminum: No
Research facilities: No
Research:
Horticulture
Breeding
Propagation
Acclimatisation
Conservation
Medicinal plants
Propagation of indigenous species
Field gene banks or living collections: Yes
In vitro *storage*: No
Pollen banks: No
DNA bank: No
Education programme: Yes
Education section: Yes
Number of staff:
1 Principal Education Officer
1 5/8 Administrative Assistant
4 Assistant Education Officers
Courses for school children, students, adults: School children
Courses on conservation: Yes. Conservation forms an integral part of the environmental education programme.
Environmental education: Yes. School programmes for all age groups linked to the formal school curriculum. Teacher development workshops are held in the garden.
Public lectures: Yes
Permanent public displays: Yes
Special exhibitions: Yes
Public education/display building: No
Issue booklets/leaflets: Yes

Figure 69. Traditional use or 'muthi' garden, Pretoria National Botanical Garden. (Photo: Pitta Joffe)

Figure 70. Succulent area, Pretoria National Botanical Garden. (Photo: Pitta Joffe)

Guided tours: Yes
Display labels: Yes
Special facilities for children: No
Training courses: Yes
Horticulture apprenticeship
Horticultural herbarium: None
Number of specimens: Not applicable
Access to other herbarium: National Herbarium (PRE)
Number of specimens: 1 200 000
Infrastructure/facilities:
Visitor centre: No
Nurseries: Yes
Greenhouses: 20 propagation structures—shadecloth, fibreglass or glass covered (5 900 m^2)
Laboratories: No
Library: No
Auditorium: No
Exhibition area: No
Quarantine station: No
Bookshop: No
Arboretum: Inside
Equipment:
Vehicles: 8
Lawnmowers: 5
Irrigation: Manual
Others: Not applicable

Number of plant taxa in garden: *ca* 5 000
Plant families represented in garden: Not accurately known
Number of threatened plant species in garden: Not accurately known
Number of visitors per annum: 120 000
Computerisation of collections: Yes, although not complete
Floras/vegetation types represented in garden: Various
Open to public: 08h00–18h00 daily
Entrance fee charged: R7 (adult), R3 (student), R3 (scholar), pensioners free on Tuesdays only
Publications: None
Assessment of needs:
Pretoria National Botanical Garden
New facilities:

- Parking facility for 250 cars and five buses.
- Entrance building: public access control to both garden and National Herbarium Lecture Hall and display facilities; information centre; book/curio shop; Garden Sales Centre; public toilets; garden administration offices.
- New staff facilities: change rooms for garden-based staff.
- Garages and stores: new facilities for garden vehicles and equipment.

- Environmental Education Centre: Lecture and display facilities; Offices; Library; Store rooms.
- Garden perimeter fencing: 3.5 km of steel/concrete palisade fencing.
- Display glasshouse: Succulent collection; Desmond Cole Lithops Collection; Madagascan flora, African epiphytic orchids.
- Restaurant: Open for evening functions, accessible from parking area.
- New staff house: Replace existing house (No.3); renovation will be too expensive.

Existing infrastructure:

- Upgrade road: Service road between nursery and garden—use existing paving bricks to complete ring road near bird sanctuary and other internal garden paths.
- Nursery production houses (5): New fibreglass sheeting.
- Glasshouse structures (3): Renovate glazing and electrical systems.
- Velcich House: Convert outside rooms into a flatlet for security purposes.
- Irrigation system: New ring supply for both nursery and garden.
- Cover existing four reservoirs.
- Workshop and stores: Renovate existing facilities.

Vehicle/equipment replacement:

- New tractor: Massey Ferguson 240/equivalent; new tip trailer for tractor.
- New tractor: Smaller tractor for lawnmowing purposes.
- New 3.5 ton truck, used for refuse removal and sundry materials transport.
- Mowers and sundry: Large turf mower; rough grass cutter; chipper; concrete mixer.

Staff Requirements:

- Training and Safety Officer: Staff Training and Development Coordinator; OHASA matters; Skills Development Act applications.
- Garden Information Officer: Guided tours; Volunteer Guide programme and training; Garden information services; Function/Activity Coordinator e.g. concerts.
- Outreach horticulturist: Community-based outreach programmes; liaison between garden and education-based activities.
- General Workers: Filling of eight labourer vacancies.

Garden Development Projects:

- Complete bird sanctuary area.
- Northern garden arboretum area.
- Display gardens: botanical terminology; handicapped gardening; geology; evolution-

Figure 71. Reynolds Gate at the entrance to the Pretoria National Botanical Garden. (Photo: H. Joffe)

ary; fragrance; early settlers plant uses; summer rainfall Proteaceae.
- Renovate and upgrade water features.
- Renovate *Aloe* display.
- Renovate *Euphorbia* display.

Remarks: This garden was originally the Botanical Garden of the old Botanical Research Institute (BRI), prior to amalgamation with the former National Botanical Gardens (NBG), and is now one of the eight regional gardens of the National Botanical Institute. The National Herbarium (with its associated taxonomic collections, databases, libraries and lecture facilities) is housed within the garden, but is managed as a separate entity. The garden was declared a National Monument in 1979.
Compilation date: September 1999
Updated: 19 June 2000

Witwatersrand National Botanical Garden (Roodepoort/ Krugersdorp)

Name of botanic(al) garden: Witwatersrand National Botanical Garden
Postal address: P.O. Box 2194, Wilro Park, 1731, South Africa
Physical address: End of Malcolm Rd, Poortview, Roodepoort/Krugersdorp, South Africa
Telephone: [27] 11/ 958 1750
Fax: [27] 11/ 958 1752
E-mail:witsnbg@mweb.co.za/ botanic@mweb.co.za
Head of Institute: Prof. Brian J. Huntley, Chief Executive Officer, National Botanical Institute, Private Bag X7, Claremont, Cape Town 7735, South Africa, huntley@nbict.nbi.ac.za
Curator and correspondent: Sharon L. Turner, b. 1971, BSc(Hons) in Botany, N.D. Hort.
Status: Parastatal, National Botanical Institute
Foundation date: 1982
Mission: To work together to create a beautiful and safe environment where the staff strive to conserve and promote South Africa's rich plant life through education and friendly service.
Size/area of garden: 300 ha
Landscaped area: 20 ha
Natural vegetation in garden: *ca* 280 ha. Rocky Highveld Grassland.
Dominant plant taxa: The vegetation is characterised by wooded grassland slopes (*Protea caffra, Acacia caffra, Cussonia paniculata* subsp. *sinuata*), rocky ridges (*Englerophytum magalismontanum, Ancylobotrys, Vangueria infausta*), and highveld riverine forest along the drainage line (*Celtis africana, Combretum erythrophyllum, Kiggelaria africana*).
Latitude: 26°05'S
Longitude: 27°50'E
Altitude: 1 500 m a.s.l.
Rainfall: 758 mm per annum
Associated reserve: 280 ha
Number of paid staff: 39
Number of volunteers: None
Number and names of horticulturists: 3
- Andrew Hankey, b. 1968, Specialist Horticulturist, N.D. Hort.
- Alice Aubrey, b. 1970, Senior Horticulturist, N.D. Hort.
- Thompson Mutshinyalo, b. 1977, Horticulturist, N.D. Hort.

Number of labour staff: 30 (includes drivers, machine operators, groundsmen, cleaners)
Working hours/day: 8 hr
Associated staff: 3 administrative staff, 2 education staff
Planting records: Partly computerised, partly paper-based (currently in the process of computerising these records)
Percentage indigenous plants: 100%
Threatened plants programme: Conservation and propagation programmes on various threatened plant taxa in association with various Nature Conservation bodies (e.g. *Aloe peglerae, Khadia beswickii, Ledebouria rupestris, Ledebouria galpinii*).
Indoor exhibition area: Yes. Nestle Environmental Education Centre (140 m^2).
Friends: Bankenveld Branch of Botanical Society, P.O. Box 5851, Weltevreden Park, 1715, South Africa

Seed bank: No
Index seminum: No
Research facilities: Allied to the Research Directorate of the National Botanical Institute
Research:
Horticulture
Taxonomy (limited)
Breeding (limited)
Propagation
Acclimatisation
Ecology (limited)
Conservation (limited)
Germination
Plant pathology (limited)
Ethnobotany (limited)
Medicinal plants (limited)
Propagation of indigenous species
Field gene banks or living collections: Special collections of selected plant taxa (*Ledebouria, Drimiopsis, Plectranthus, Aloe, Watsonia, Kniphofia, Agapanthus, Zantedeschia, Clivia, Crinum*)
In vitro *storage*: No
Pollen banks: No
DNA bank: No
Education programme:
Education section: Yes
Number of staff:
1 full-time education officer
1 5/8 administrative assistant
24 part-time education officers
Courses for school children, students, adults: Yes
Courses on conservation: Occasional
Environmental education:
- School programme linked to curriculum for both primary and secondary school pupils

Figure 72. The Witpoortjie Waterfall forms the centrepiece of the Witwatersrand National Botanical Garden. (Photo: Sharon Turner)

Figure 73. Sign donated by the Black Eagle Project. (Photo: G. Heydenrych)

Figure 74. Entrance building with 'bokbaaivygies' (Mesembryanthemaceae). (Photo: Sharon Turner)

- Teacher workshops

Public lectures: Occasional
Permanent public displays: No
Special exhibitions: No
Public education/display building: Occasional
Issue booklets/leaflets: Limited
Guided tours: On request
Display labels: Limited
Special facilities for children: Programmes available for all ages
Training courses:
Horticulture (occasional)
Gardening (occasional)
Horticulture apprenticeship (not at present)
Herbarium: Local herbarium representing the natural flora of the estate
Number of specimens: *ca* 1 500
Access to other herbarium: National Herbarium, Pretoria (PRE) and C.E. Moss Herbarium (J, University of the Witwatersrand)
Number of specimens: 1 200 000 (PRE); 100 000 (J)
Infrastructure/facilities:
Visitor centre: None—information available at curio/bookshop at entrance.
Nurseries:

- Index nursery—grows plants for use in botanical garden and houses the special collections.
- Retail nursery—sells indigenous plants to garden visitors.

Greenhouses:

- Six propagation structures (1 502 m^2), including
- Propagation house (60 m^2), succulent facility (72 m^2)

Laboratories: None
Library: Yes. Botanical and natural history reference library.
Auditorium: None
Exhibition area: Nestle Environmental Education Centre
Quarantine station: None
Bookshop: Yes—together with curio and gift shop
Arboretum: Inside garden
Equipment:
Vehicles:

- 2 tractors (one with trailer, one with payloader)
- 3 bakkies
- 1 AMC staff bus (30-seater)
- 1 3-ton truck

Lawnmowers: 2 ride-on rotary mowers
Irrigation: Manual system
Others: Brushcutter, chain saws, rotavator
Number of plant taxa in garden: 370 genera, *ca* 2 000 species
Plant families represented in garden: Not accurately known
Number of threatened plant species in garden: 163
Number of visitors per annum: 122 855 (in 1999)
Computerisation of collections: Partly computerised—plant records are being entered in new Plant Records Database
Floras/vegetation types represented in garden: All collections from the Flora of Southern Africa (summer rainfall) region.
Open to public: Every day, 08h00–18h00
Entrance fee charged: Yes. R10 per adult, R5 per scholar and students, senior citizens free on Tuesday, Botanical Society members free entrance.
Publications: *BotSoc Chat*, quarterly newsletter of the Bankenveld Branch of the Botanical Society.
Assessment of needs:
New facilities:

- Garden Centre, shop, redevelopment of entrance and visitor facilities.
- New restaurant.
- Conservatory/glass house.
- Soil mixing and storage areas.
- Potting shed in index nursery.
- Propagation beds in index nursery.
- Poison store.
- Office for education staff.

Upgrading/replacement of existing facilities:

- Repair and recladding of motor bridge.
- Development of overflow parking area.
- Upgrade service roads.
- Surfacing of roads in index nursery.
- Surfacing of work area and yard at stores.

Replacement of movable capital equipment:

- 4x4 vehicle for field work and estate management.
- Two Massey Ferguson 240 tractors or equivalent.
- Bus for outreach education work.

New Garden Development:
- Development of magico-medicinal garden and fragrance garden.
- Redevelopment of succulent garden.
- Reconstruction of water garden.
- Geological garden development.
- Turf grass demonstration garden.
- Frost demonstration garden.
- Sasol Dam marsh extension, drainage and repairs.
- Development of a demonstration food garden at education centre.
- Potting facilities at education centre.

Estate:
- Fencing.
- Alien control.
- Erosion control.

Human Resources:
- Additional horticulturist/botanist post.
- Full-time education administrative assistant.
- Outreach education officer.
- Groundsmen posts—currently seven are vacant yet unfilled.

Information:
- Complete computerisation of garden records.
- Labelling of plants in garden.

Compilation date: March 1999
Updated: 7 September 2000

Figure 75. Water garden, Witwatersrand National Botanical Garden. (Photo: Sharon Turner)

Box 11. Past and Present Curators of Selected Southern African Botanic(al) Gardens

SOUTH AFRICA

Durban Botanic Gardens

- Dr Charles Johnston (December 1849–October 1850)
- Mark James McKen (June 1851–July 1853)
- Alexander Smith (August 1853–August 1854)
- Robert Plant (July 1854–July/August 1856)
- James Weir (July 1856–July 1857)
- Robert Rogers (July 1857–February 1859 (dismissed))
- De La Chaumette (January 1859–May 1859)
- Alfred Moore (May 1859–December 1860)
- Mark James McKen (December 1860–April 1872)
- J.H. Steel (caretaker during McKen's illness, 1872)
- Thomas Ridsdale (caretaker between McKen and Keit)
- William Keit (January 1873–February 1882)
- J. Medley Wood (Curator)(March 1882–December 1903)
- J. Medley Wood (Director)(January 1904–June 1913)
- J. Medley Wood (Director of Herbarium) (1886–August 1915)
- James Wylie (1904–16)
- Henry Rutter (1917–30)
- William Poulton (in charge)(1930–2)
- Frank W. Thorns (botanical assistant) (1932–6)
- Ernest R. Thorp (in charge)(1936–1950)
- Ernest Thorp (1950–July 1975)
- Kenneth J. Wyman (August 1975–November 1995)
- Christopher G.M. Dalzell (May 1996–present)

Free State National Botanical Garden

- Mr Gerald M.L. Feinhauer (July 1967–May 1975)
- Mr Peter J. Chaplin (July 1975–June 1982)
- Mr Ian B. Oliver (July 1982–December 1991)
- Mr Ben Engelbrecht (January 1992–December 1993)
- Mr Rudi M. Britz (January 1994–October 1998)
- Mr Amadeus Mogale (November 1998–present)

Harold Porter National Botanical Garden

- Mr Veldsman (foreman assisting Mr HN Porter when Harold Porter NBG was still a private reserve)
- Mr Ryk Grunewald (foreman assisting Mr HN Porter when Harold Porter NBG was still a private reserve)
- Mr H.F. Wood (1959)(foreman assisting Mr HN Porter when Harold Porter NBG was still a private reserve)
- Mr Wim J. Tijmens (February 1960–July 1962)
- *Vacant* (August 1962–March 1963). Garden managed by Mr Bernard Vogts.
- Mr W.P. (Wim) Topper (April 1963–December 1966)
- *Vacant* (January 1967–October 1967). Mr Bernard Vogts and Mr J.A. Marais (Curator of Kirstenbosch) supervised the Garden (the latter once a fortnight).
- Mr Wessel C. Ebersohn (November 1967–May 1976)
- Mr Brian B. Tarr (July 1976–July 1979)
- *Vacant* (August 1979–March 1980). Garden run by the Foreman, Mr Leslie Harper and six groundsmen.
- Mr Alfred van der Zeyde (April 1980–June 1985)
- Mr Donald H. McKenzie (July 1985–June 1988)
- Mr Alfred van der Zeyde (July 1988–November 1988)
- Mr Hans Heilgendorff (December 1988–November 1991). A full-time horticulturist (Ms J.A. Forrester) was appointed for the first time to assist the Curator in August 1991.
- *Vacant* (December 1991–February 1992). Garden managed by Ms Forrester.
- Mr Rudi Britz (March 1992–January 1994)
- Ms C.M. (Karin) Behr (February 1994–present)

Karoo Desert National Botanical Garden
- *Vacant* (1921–1924)
- Mr Joseph Archer (1925–January 1939)
- *Vacant* (February 1939–July 1945)
- Mr Jacques Thudichum (August 1945–1958)
- Mr Frank J. Stayner (1959–1973)
- Mr M. Bruce Bayer (1973–1987)
- Mr Ben Engelbrecht (May 1987–December 1991)
- Mr Ian B. Oliver (January 1992–present)

Kirstenbosch National Botanical Garden
- Mr Joseph W. Mathews (1913–1936)
- Mr Frank W. Thorns (1936–1947)
- Mr Hilbert F. Werner (1948–1959)
- Mr Jack A. Marais (1959–1979)
- Mr John H.S. Winter (1979–1997)
- Mr Adnaan Abrahams (1997–1998)
- Mr Philip le Roux (1999–present)

Lowveld National Botanical Garden
- Mr J.P. (Koos) Nel (1969–1974)
- Mr Peter R. Kruger (1974–1980)
- Mr Johan P. Kluge (1980–1998)
- Mr Rudi M. Britz (1998–present)

Natal National Botanical Garden
- Mr Peter A.S. Law (1969–1979)
- Mr Brian B. Tarr (1979–present)

Pretoria National Botanical Garden
Directors
Pre-amalgamation
- Dr R.A. Dyer (1944–1963)
- Dr L.E.W. Codd (1963–1973)
- Dr B. de Winter (1973–1989)

Post-amalgamation (amalgamation in 1989)
- Dr D.J. Botha (1985–2000)
- Mr C.K. Willis (2000–present)

Curators
Pre-amalgamation
- Mr Jan Erens (Chief Horticulturist) (?–1952)
- Mr Johannes Admiraal (1965–1977) (appointed as horticulturist in 1952, promoted to the garden's first Curator in 1965)
- *No appointment between 1977 and 1983*
- Mr Danie Dry (1983–1991)

Post-amalgamation
- Mr Danie Dry (1983–1991)
- Mr Hans Heilgendorff (1991–present)

Witwatersrand National Botanical Garden
- Mr Peter J. Chaplin (1982–2000)
- Ms Sharon L. Turner (2000–present)

Drakensberg and Eastern Free State National Botanic Garden
- Mr Alfred van der Zeyde (1967–1980)
- Mr Jacobus Roux (1980–1984)
- Garden closed in 1984.

ZAMBIA
- Mr Ralph Sander (Founding Curator) (1950–1968)
- Mr Mike Hall (1968–1973)
- Mr (Major) Alick Chanda (1973–1991)
- Mrs Mutale (1991–1997)
- Mr Douglas Gibbs (1999–present)

Zambia

Munda Wanga Trust Botanical Garden (Chilanga)

Name of botanic(al) garden: Munda Wanga Trust (the botanical garden forms part of the Trust)
Postal address: P.O. Box 38267, Lusaka, Zambia
Physical address: Plot 75, Kafue Road, Chilanga
Telephone: [260] 1/ 278456
Fax: [260] 1/ 278529
E-mail: biopark@zamnet.zm
Managing Director: Mr J.W. Thomas, b. 1947 (Conservation, education, history)
Botanical Manager and correspondent: Douglas R.N. Gibbs, b. 1972 (Botanical conservation)
Status: State (leased by Munda Wanga Limited from National Parks and Wildlife, Zambia)
Foundation date: 1950
Mission: The Munda Wanga Trust will exhibit and care for indigenous and exotic animals and plants in order to foster understanding, knowledge, research, care and appreciation of our biological heritage and associated ecological considerations, for the benefit of the community at large.
Objectives:

- The development of the zoological and botanical gardens in keeping with modern theory and practice.
- The acquisition, exhibition, propagation and care of indigenous and exotic animals, birds, reptiles, fish, trees, plants and other living matter in order to foster understanding, knowledge, research, care of, and appreciation of human biological inheritance and associated ecological considerations.
- The advancement of conservation, recreation and research for the benefit of the community at large.
- The advancement of education by giving or arranging lectures, discussions, demonstrations, exhibitions, meetings or gatherings in furtherance of the objectives of the Company.

Size/area of garden: Currently 5 ha (will be expanded by additional 40–50 ha, mostly indigenous)
Landscaped area: 100%
Natural vegetation in garden: 0%
Latitude: 15°34'S
Longitude: 28°16'E
Altitude: 1 100 m a.s.l.
Rainfall: 1 000 mm per annum
Associated reserve: Munda Wanga Wildlife Park and Sanctuary
Number of paid staff: 9
Number of volunteers: Currently planning a "Friends of Munda Wanga"
Number and names of horticulturists: 3

- Douglas R.N. Gibbs, b. 1972 (botanical conservation)
- Webby Hankobo, b. 1974
- George Shipanuka, b. 1949 (Supervisor)

Number of labour staff: 7
Working hours per day: 8 hours
Associated staff: None
Planting records: None
Percentage indigenous plants: 30%
Threatened plants programme: None
Indoor exhibition area: None
Friends: Currently planning a "Friends of Munda Wanga"
Seed bank: No
Index seminum: No
Research facilities: None
Research: Can be used as resource for research, but not currently used for this purpose.
Field gene banks or living collections: Garden
In vitro *storage*: None
Pollen banks: None
DNA bank: None
Education programme: Planned
Education section: None
Number of staff: No dedicated education staff
Courses for school children, students, adults: None
Courses on conservation: None
Environmental education: No
Public lectures: No
Permanent public displays: No
Special exhibitions: No
Public education/display building: None
Issue booklets/leaflets: No
Guided tours: No
Display labels: Yes, engraved plastic. Limited number, but increasing.

Special facilities for children: None
Training courses: No
Horticultural herbarium: No
Number of specimens: Not applicable
Access to other herbarium: Mount Makulu Research Station Herbarium (MRSC) and the University of Zambia Herbarium (UZL)
Number of specimens: 30 000 (MRSC); 25 000 (UZL)
Infrastructure/facilities:
Visitor centre: Planned
Nurseries: 1 shade house (200 m^2); outdoor nursery area and propagation beds (total area: 1 500 m^2)
Greenhouses: 1 plastic propagation greenhouse under construction (20 m^2)
Laboratories: No
Library: No
Auditorium: Planned
Exhibition area: Planned
Quarantine station: No
Bookshop: In the process of being stocked, located in the new entrance building.
Arboretum*: Planned*
Equipment:
Vehicles:
1 pick-up
2 planned
Lawnmowers:
1 electric Honda lawnmower (additional one planned)
Irrigation: Planned
Others: Not applicable
Number of plant taxa in garden: *ca* 1 000
Plant families represented in garden:
Acanthaceae
Arecaceae
Asphodelaceae
Boraginaceae
Cactaceae
Cassuarinaceae
Euphorbiaceae
Fabaceae
Moraceae
Myrtaceae
Nyctaginaceae
Nymphaeaceae
Poaceae

Figure 76. Variegated Furcraea foetida *'Mediopicta' (Agavaceae), a native of the West Indies, cultivated as a specimen in an open bed in Munda Wanga Trust Botanical Garden, Chilanga, Zambia. The plant is here incorrectly labelled as* Agave americana. *(Photo: Gideon Smith)*

Figure 77. Munda Wanga Trust. The Musamba Ngombe stream. (Photo: Douglas Gibbs)

Solanaceae
Zamiaceae

Number of threatened plant species in garden: 1, *Encephalartos trispinosus*

Number of visitors per annum: Currently 15 000–20 000

Computerisation of collections: Planned

Floras/vegetation types represented in garden: Not applicable

Open to public: Yes, 08h00–17h00 (Monday–Sunday)

Entrance fee charged: Yes, ZMK5 000 adults, ZMK2 500 children

Publications: Brochures, newsletters planned

Assessment of needs:

- Visitor centre needed.
- Nurseries required.
- Fenced boundary.
- Interpretive signage.
- Plant labels.
- Nursery/propagation area needs to be developed and improved.
- Auditorium.
- Exhibition area.
- Bookshop.
- Arboretum.
- Lawnmowers.
- Irrigation.
- Computerisation of collections.

Training needs for staff:

- Botanical garden management.
- Plant identification.
- Propagation methods.
- Landscaping.
- Nursery management.
- Plant records.
- Pest control.
- Irrigation.
- Environmental education.
- Labelling/interpretational signage.
- Basic knowledge of mechanics of equipment and equipment maintenance.

Remarks:

Would like to receive seeds, live material, bulbs, etc. of indigenous plants of south-central Africa in general, and Zambia in particular.

Compilation date: 27 July 1999

Updated: 27 June 2000

Figure 78. Munda Wanga Trust. The top terrace. (Photo: Douglas Gibbs)

Figure 79. Munda Wanga Trust. The bird fountain. (Photo: Douglas Gibbs)

Zimbabwe

National Botanic Garden (Harare)

Name of botanic(al) garden: National Herbarium and Botanic Garden
Postal address: P.O. Box CY550, Causeway, Harare, Zimbabwe
Physical address: Opposite Downie Avenue, at junction of 5th street and Sandringham Drive, Alexandra Park, Harare, Zimbabwe
Telephone: [263] 4/ 744 170/725 313/708 938
Fax: [263] 4/ 708 938/728 317
E-mail: srgh@icon.co.zw
Head of Institute and correspondent: Nozipo Nobanda, b. 1956, MSc (Plant ecology, vegetation surveys)
Curator: Ezekiel G. Kwembeya, b. 1972, MSc (Plant taxonomy)
Assistant Curator: Tawanda Ganda, b. 1967, N.D. Hort. (Horticulture)
Status: State, Department of Research and Specialist Services (DR&SS, within the Ministry of Lands and Agriculture)
Foundation date: 1962
Mission: To increase knowledge and appreciation of Zimbabwean plants, their identity, distribution, uses, conservation and cultivation, through displaying and managing the living collections.
Size/area of garden: 68 ha
Landscaped area: *ca* 48 ha
Natural vegetation in garden: *ca* 20 ha, miombo vegetation (dominated by *Brachystegia* and *Julbernardia*)
Latitude: 17°48'S
Longitude: 31°03'E
Altitude: 1 500 m a.s.l.
Rainfall: 800 mm per annum
Associated reserve: Mazoe Botanic Reserve, Christonbank (46.5 ha of relatively undisturbed miombo woodland with riverine elements and granite kopjes), 32 km north of Harare
Number of paid staff: 27
Number of volunteers: 3 full-time (Thomas Müller, Tom Gentleman, Des F. Lovemore)
Number and names of horticulturists: 3

- Tawanda Ganda, b. 1967, N.D. Hort. (Horticulture)
- Esther Makombe, b. 1963, N.D. Hort. (Horticulture)
- Allen Micho, b. 1966, N.D. Hort. (Horticulture)

Number of labour staff: 25 (two of which are security staff)
Working hours/day: 8 hours
Associated staff:

- Thomas Müller, 1932 (ex-curator of the garden)
- Tom Gentleman (financial advisor)
- Des F. Lovemore (advisor and troubleshooter)

Planting records: Card system, but information from *ca* 1 500 cards has been transferred onto computer
Percentage indigenous plants: *ca* 95%, trees and shrubs (woody plants)
Threatened plants programme: Garden is used as a refuge for threatened plants
Indoor exhibition area: Desert House with a collection of over 240 plant species comprising over 400 specimens from the arid and semi-arid areas of southern Africa. The Desert House is divided into four main sections, namely Kaokoveld, the Namib Desert, the winter rainfall region and Zimbabwe.
Friends: Friends of the Botanic Garden, c/o National Herbarium and Botanic Garden, P.O. Box CY 550, Causeway, Harare, Zimbabwe
Seed bank: Yes (seed store)
Index seminum: Yes (*ca* 302 taxa)
Research facilities: None
Research:
Horticulture
Propagation
Conservation
Germination
Propagation of indigenous species
Field gene banks or living collections: Living collections in the garden; Mazoe Botanic Reserve
In vitro *storage*: No
Pollen banks: No
DNA bank: No
Education programme:
Education section: Soul Shava, b. 1967 (Education Officer)
Number of staff: 8 staff members of the National Herbarium and Botanic Garden assist the Education Officer
Courses for school children, students, adults: Yes
Courses on conservation: Yes

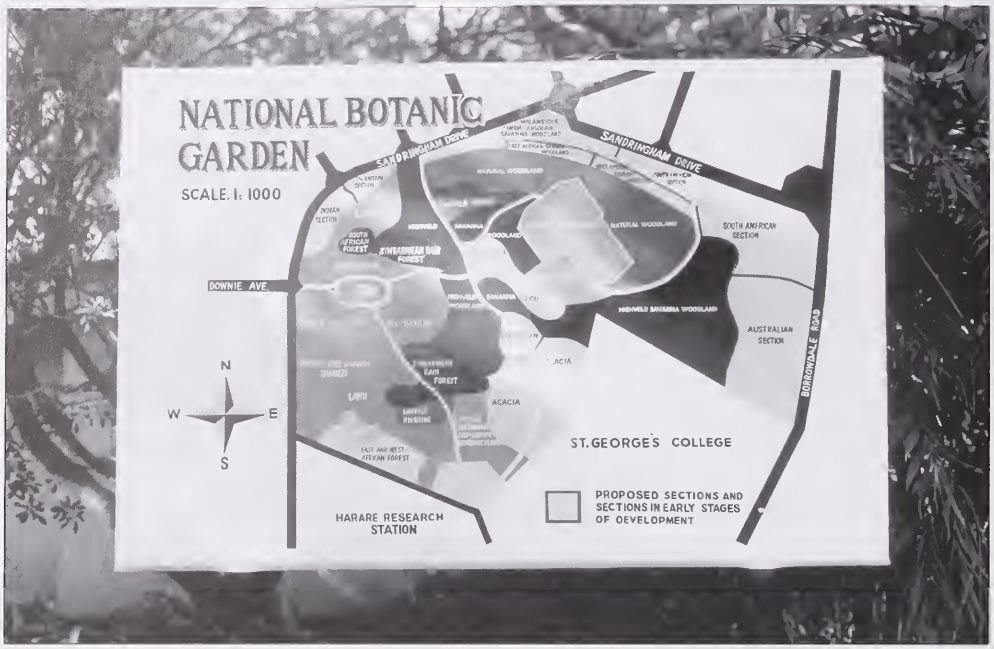

Figure 80. Map showing the different sections within the National Botanic Garden, Zimbabwe. (Photo: Christopher Willis)

Environmental education: Yes
Public lectures: Yes
Permanent public displays: Yes
Special exhibitions: Yes, occasionally
Public education/display building: Yes
Issue booklets/leaflets: Map and Garden Guide on sale
Guided tours: Yes. Mostly for colleges, schools (primary and secondary), clubs, universities, colleges, associations and farmer groups
Display labels: Yes. Most made on computerised engraving machine (Meistergram) linked to the Dbase IV plant records database, others with a manual engraving machine. Labels include common names in English, Shona and Ndebele, accession number, month and year of planting.
Special facilities for children: No
Training courses: No
Horticulture apprenticeship: Students mostly from the Polytechnics (three month block release on attachment)
Horticultural herbarium: No
Number of specimens: Not applicable
Access to other herbarium: National Herbarium of Zimbabwe (SRGH)
Number of specimens: *ca* 500 000
Infrastructure/facilities:
Visitor centre: Yes, an auditorium
Nurseries: 1
Greenhouses: 3
Laboratories: None
Library: Yes. In the National Herbarium. (Few horticultural books, and most of these are old.)
Auditorium: Yes (holds 120 people)
Exhibition area: Auditorium
Quarantine station: None
Bookshop: None
Restaurant: Yes
Arboretum: No
Equipment:
Vehicles: 1 small tractor
Lawnmowers: 4 push mowers and 2 tractor-drawn
Irrigation: Yes; forest sections, surrounds of tea house, auditorium, car park and herbarium
Others:
Trailer
4 brushcutters
2 chainsaws
Compressor

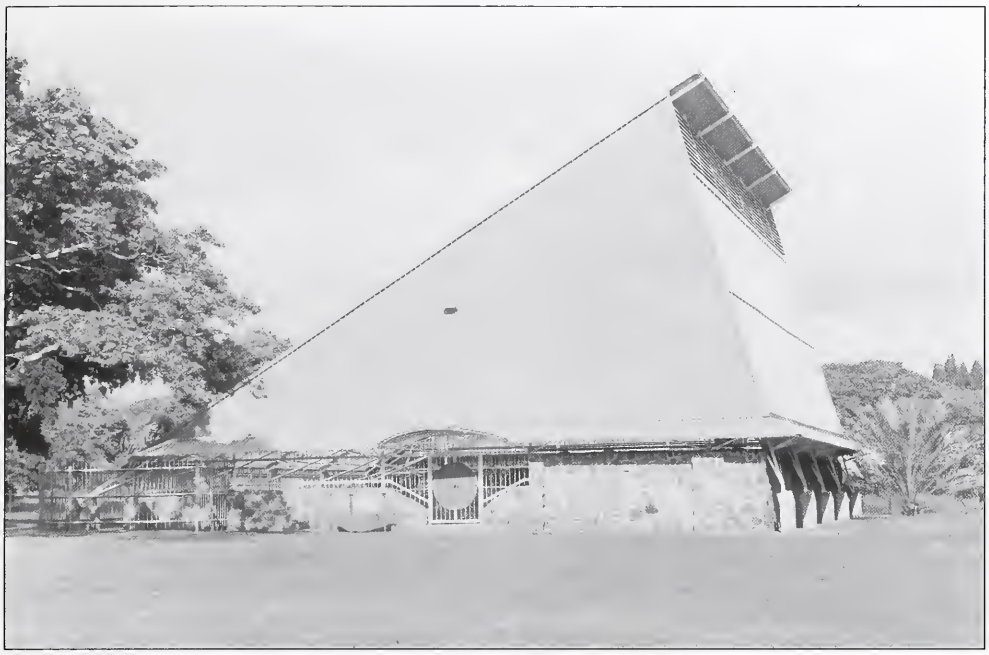

Figure 81. Desert House, National Botanic Garden, Zimbabwe. (Photo: Christopher Willis)

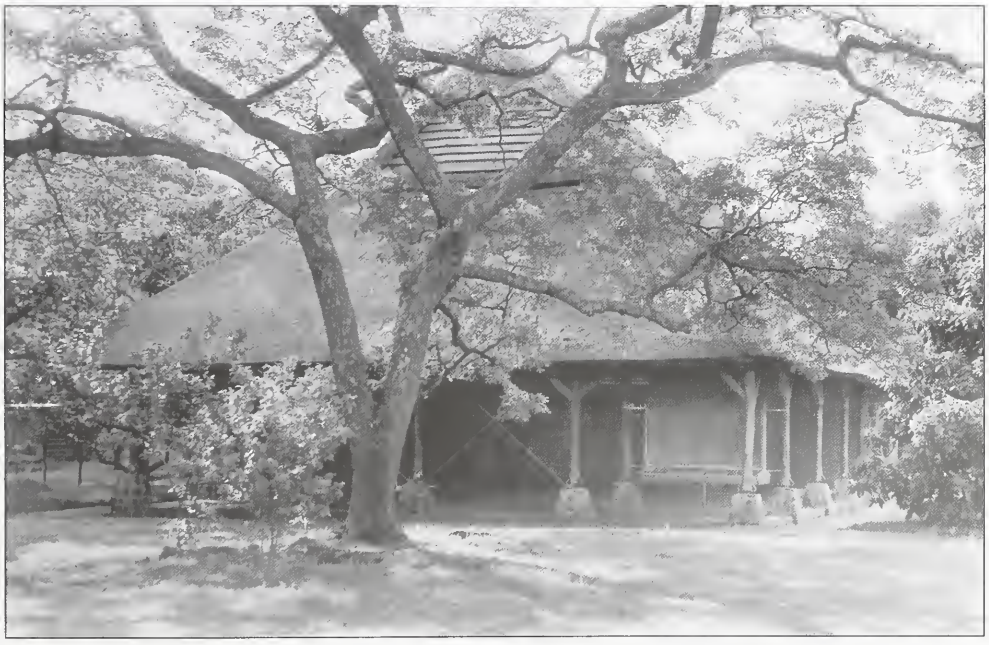

Figure 82. Education Centre, National Botanic Garden, Zimbabwe. (Photo: Christopher Willis)

Welding machine
Motorised mist blower
2 knapsack sprayers
Extension ladder
Manual engraving machine
Computer engraver

Number of plant taxa cultivated in garden: *ca* 2 000 woody trees and shrubs

Major plant families represented in garden:
Burseraceae
Combretaceae
Euphorbiaceae
Fabaceae
Liliaceae
Moraceae

Number of threatened plant species in garden: Yes, but actual number unknown

Number of visitors per annum: *ca* 30 000

Computerisation of collections: Currently using a programme written in Dbase IV

Floras/vegetation types represented in garden: Miombo woodland; Forest (low, medium and high altitude forest); semi-arid regions of southern Africa (Zambezi and Limpopo areas)

Open to public: 06h00–18h00

Entrance fee charged: Yes; from 09h00–18h00. Parking: Z$5, adults: Z$5, children: Z$2, dogs: Z$2

Publications: Annual newsletter: "Friends of the Botanic Garden Newsletter"; National Herbarium and Botanic Garden Annual Report, Index Seminum, plant booklets and posters

Equipment needs:
- Tractor (240 Massey Ferguson, 80 hp) and tip trailer.
- Propagation house.
- 25-seater minibus (transport for staff to and from the city).
- Poison storeroom.
- Fuel storeroom.
- Fertilizer storeroom.
- Additional boreholes (alternatively, deepening of existing boreholes).
- Subsoiler.
- Chipper.
- 80 sprinklers.
- Motorbikes/bicycles.
- Eight two-way radios.
- Two base stations in Harare and Mazoe.
- One-man rowing boat.
- Slasher/rotary mower for tractor.

Staffing needs:
- Eleven existing posts (currently frozen).

General needs:
- Soil sterilisation.
- Master/strategic plan.
- Map showing the irrigation network of the Garden.

Remarks: Two staff houses on site

Compilation date: 26 August 1998

Updated: 8 September 2000

Figure 83. Forest section, National Botanic Garden, Zimbabwe. (Photo: Christopher Willis)

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APPENDICES

Appendix 1. Questionnaire

Name of botanic(al) garden:

Postal address:

Physical address:

Telephone:

Fax:

E-mail:

Director/Head of Institute:

Curator and correspondent (name of senior person in charge of the garden):

Status (state/municipal/university/private/autonomous/educational):

Foundation date (year only):

Mission:

Size/area (ha) of garden:
- Landscaped area:
- Natural vegetation in garden (with vegetation type, size in hectares, dominant plant taxa):

Latitude:

Longitude:

Altitude (metres only):

Rainfall (mm only):

Associated reserve (with vegetation type, size in square metres):

Number of paid staff:

Number of volunteers:

Number and names of horticulturists:

Number of labour staff:

Working hours/day:

Associated staff:

Planting records (computer/paper-based/none/in progress):

Percentage indigenous plants:

Threatened plants programme:

Indoor exhibition area:

Friends (with address):

Seed bank (yes/no):
- Index seminum:

Research facilities (yes\no; laboratory, allied research institute):

Research (options available are listed below):
- Horticulture
- Taxonomy
- Physiology
- Breeding
- Propagation
- Acclimatisation
- Ecology
- Biochemistry
- Anatomy
- Cytology
- Conservation
- Forestry
- Germination
- Plant pathology
- Mycology
- Ethnobotany
- Medicinal plants
- Tissue culture
- Propagation of indigenous species
- Reproductive biology

Field gene banks or living collections:

In vitro storage:

Pollen banks:

DNA bank:

Education programme:
- Education section
- Number of staff
- Courses for school children, students, adults
- Courses on conservation
- Environmental education
- Public lectures
- Permanent public displays
- Special exhibitions
- Public education/display building
- Issue booklets/leaflets
- Guide tours
- Display labels
- Special facilities for children

Training courses (Yes\No):
- Horticulture
- Gardening
- Botany
- Horticulture apprenticeship

Horticultural herbarium:
- Number of specimens:

Access to other herbarium (with acronym):
- Number of specimens:

Infrastructure\facilities:
- Visitor centre:
- Nurseries:
- Greenhouses (number and size in square metres):
- Laboratories:
- Library:
- Auditorium:
- Exhibition area:
- Quarantine station:
- Bookshop:

Arboretum (inside garden, outside garden):

Equipment:
- Vehicles:
- Lawnmowers:
- Irrigation:
- Others:

Number of plant taxa in garden:

Plant families represented in garden:

Number of threatened plant species in garden:

Number of visitors per annum:

Computerisation of collections:

Floras\vegetation types represented in garden:

Open to public (opening times):

Entrance fee charged (yes\no and value in local currency):

Publications (regular newsletters, any other publications about garden):

Assessment of needs:

Remarks:

Compilation Date:

Appendix 2.
Southern African Botanic(al) Gardens: Contact Names and Addresses

ANGOLA
No botanical garden

BOTSWANA
National Botanical Garden
Curator: Mr Nonofo Mosesane
Private Bag 114
Gaborone
Botswana
Tel.: [267] 373860
Fax: [267] 311186
E-mail: None

LESOTHO
Katse Botanical Garden
Curator: Mr Tau Mahlelebe
P.O. Box 7332
Maseru 100
Lesotho
Tel.: [266] 311280 (Maseru) or 910209 (Katse)
Fax: [266] 316236
Cell: [266] 858587
E-mail: mahlet@lhda.org.ls

MALAWI
Lilongwe National Botanic Garden
Curator: Mr Ignatius A. Malota
National Herbarium and Botanic Gardens of Malawi
P.O. Box 30766
Capital City
Lilongwe 3
Malawi
Tel.: [265] 730 275
Fax: via [265] 524 108
E-mail: via Augustine Chikuni:
augustine@sdnp.org.mw

Mzuzu National Botanic Garden
Curator: Vacant
National Herbarium and Botanic Gardens of Malawi
P.O. Box 689
Mzuzu
Malawi
Tel.: via [265] 525 388/145/118
Fax: via [265] 524 108
E-mail: via Augustine Chikuni:
augustine@sdnp.org.mw

Zomba National Botanic Garden
Curator: Mr Mphamba W. Kumwenda
National Herbarium and Botanic Gardens of Malawi
P.O. Box 528
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Table 1. Summary statistics of the 20 botanical gardens surveyed, showing, amongst others, staffing levels, nurseries, greenhouses and natural versus landscaped areas.

Botanical Garden	Foundation date	Landscaped area (ha)	Natural area (ha)	Altitude (m)	Annual rainfall (mm)	Number of paid staff	Number of volunteers	Number of horticulturists	Number of labour staff	% indigenous plants	Nurseries	Greenhouses	Number of visitors per annum
Botswana National Botanical Garden, Gaborone	1978	1	6	1 000	400–450	6	0	2	4	90	1 (3 x 9 m)	0	Not known
Lesotho Katse Botanical Garden	1995	8	9	2 150	800	2	0	0	23 (contract)	90	1	planned	*ca* 200
Malawi Lilongwe National Botanic Garden, Lilongwe	1989	30	100.7	1 100	2 000	5	0	1	26	50	1	1 (12 x 30 m) 1 (5 x 3 m)	Not known
Malawi Mzuzu National Botanic Garden, Mzuzu	1989	6	472.4	950	3 000	7	0	1	17	99	1	0	Not known
Malawi Zomba National Botanic Garden, Zomba	Between 1891 and 1895	30	20	1 000	2 000	13	0	2	24	80	1	1 (5 x 5 m)	1 200
Mozambique INIA Botanical Garden, Maputo	1968	4	12	60	600–1 200	7	0	0	6	90	1	2 (20 x 10 m)	*ca* 200
Mozambique Tunduru Botanical Garden, Maputo	1885	6.4	0	30	600–1 200	58	0	0	45	Unknown	1	1 (1 800 m^2)	*ca* 2 000
Mozambique University Botanical Garden, Maputo	1976	6.4	1.6	25	600–800	16	0	0	6	90	1	1	*ca* 1 000
Namibia National Botanic Garden, Windhoek	1969	0	12	1 700	360	6	0	1	5	99	1	2 (8 m^2)	*ca* 200
South Africa Durban Botanic Gardens	1849	14.5	0	Sea level	1 700	39	25	2	31	30	1	1 (1 400 m^2)	*ca* 400 000

Botanical Garden	Foundation date	Landscaped area (ha)	Natural area (ha)	Altitude (m)	Annual rainfall (mm)	Number of paid staff	Number of volunteers	Number of horticulturists	Number of labour staff	% indigenous plants	Nurseries	Greenhouses	Number of visitors per annum
South Africa Free State NBG, Bloemfontein	1967	6.7	66.8	1 400	200–1 200	25	0	2	21	100	1	2 (583 m^2)	32 000
South Africa Harold Porter NBG, Betty's Bay	1959	10	190.5	15–360	1 109	18	28	1	15	100	1	1 (60 m^2)	52 000
South Africa Karoo Desert NBG, Worcester	1921	11	143	330	250	26	1 (permanent) and up to 12 per annum	2	17	99	3	7 (2 200 m^2)	30 000
South Africa Kirstenbosch NBG, Cape Town	1913	38	470	100–1 086	1 440	160–170	20–200	15	128	99.9	2	27 (covering *ca* 3 200 m^2)	680 000
South Africa Lowveld NBG, Nelspruit	1970	25	134	640	750	42	7 volunter garden guides	2	38	99	2	11 (4 700 m^2)	68 000
South Africa Natal NBG, Pietermaritzburg	1874	12	40	700	900	28	0	1	23	75	1	2 (504 m^2) 1 Tunnel (210 m^2)	60 000
South Africa Pretoria NBG, Pretoria	1946	50	16	1 360	750	81	variable	4	73	98	1	20 propagation structures (*ca* 5 900 m^2)	120 000
South Africa Witwatersrand NBG, Roodepoort/ Krugersdorp	1982	20	280	1 500	758	39	0	3	30	100	1	6 (*ca* 1 502 m^2)	122 855
Zambia Munda Wanga Trust Botanical Garden, Chilanga	1950	5	0	1 100	1 000	9	0	2	7	30	planned	0	15 000–20 000
Zimbabwe National Botanic Garden, Harare	1962	48	20	1 500	800	27	3	3	25	95	1	3	30 000

Table 2. Summary statistics of the 20 botanical gardens surveyed, showing, amongst others, research areas, threatened plants, programmes and computerisation of the collections.

Botanical Garden	Planting Records	Threatened plants programme	Number of threatened plant species	Number of plant taxa	Seed Bank	Index Seminum	Research	In vitro storage	Pollen Bank	DNA Bank	Computerisation of collections	Floras/ vegetation types represented
Botswana National Botanical Garden, Gaborone	None	None	Not known	Not known	No	No	Propagation Ecology Conservation Ethnobotany	No	No	No	No	*Acacia* savanna; granite inselberg vegetation
Lesotho Katse Botanical Garden	Paper-based	Initial stages of development (*Aloe polyphylla*; medicinal plants)	Two genera (*Kniphofia* and *Aloe*)	*ca* 400	Yes, through NPGRC, Maseru	No	Horticulture Propagation Acclimatisation Conservation Germination Ethnobotany Medicinal plants Propagation of indigenous species	No	No	No	Planned	Alpine Grassland Flora
Malawi Lilongwe National Botanic Garden, Lilongwe	None	Currently being initiated	Records incomplete	Uncertain	No	No	Horticulture Taxonomy Propagation Conservation Germination Propagation of indigenous species	No	No	No	No	*Combretum–Acacia* woodland
Malawi Mzuzu National Botanic Garden, Mzuzu	None	Currently being initiated	Records incomplete	Uncertain	No; seed stored in office	No	Horticulture Conservation Germination Propagation of indigenous species	No	No	No	No	*Uapaca–Brachystegia* woodland
Malawi Zomba National Botanic Garden, Zomba	None	None, currently being initiated	Records incomplete	Uncertain	No. Seed stored in offices	Last produced in 1995. Currently none available	Horticulture Physiology Propagation Conservation Germination Mycology Ethnobotany Medicinal plants Propagation of indigenous species	No	No	No	No	Semi-evergreen riverine vegetation

Botanical Garden	Planting Records	Threatened plants programme	Number of threatened plant species	Number of plant taxa	Seed Bank	Index Seminum	Research	In vitro storage	Pollen Bank	DNA Bank	Computerisation of collections	Floras/ vegetation types represented
Mozambique INIA Botanical Garden, Maputo	None	Planned	*ca* 10 species	*ca* 250 intensive inventory needed	Yes, through NPGRC	Planned	Horticulture (planned) Taxonomy (through LMA) Propagation (planned) Conservation (planned) Forestry Germination (planned) Ethnobotany Medicinal plants Tissue culture (planned) Propagation of indigenous species (planned)	No	No	No	No (planned)	Savanna, coastal vegetation
Mozambique Tunduru Botanical Garden, Maputo	Yes. Prepared by A. Balsinhas	Some threatened plants in greenhouse	Unknown	*ca* 230	No	None	None	No	No	No	No	Mainly exotic
Mozambique University Botanical Garden, Maputo	Currently paper-based; planned to be computerised	Planned	15–20	*ca* 200	Yes	Yes	Taxonomy Physiology Ecology Conservation Ethnobotany Medicinal plants Tissue culture Propagation of indigenous species	No	No	No	Planned	Coastal vegetation, garden based on economic uses of plant species
Namibia National Botanic Garden, Windhoek	None. Checklist of garden flora available	None	*ca* 5	120	No	None	Research conducted by NBRI. Taxonomy Ecology Conservation Medicinal plants Tissue culture research conducted by PALM-DAT	National Gene Bank	No	No	No	Highland savanna with introductions from Kaokoveld and the Namibian escarpment

Botanical Garden	Planting Records	Threatened plants programme	Number of threatened plant species	Number of plant taxa	Seed Bank	Index Seminum	Research	In vitro storage	Pollen Bank	DNA Bank	Computerisation of collections	Floras/ vegetation types represented
South Africa Durban Botanic Gardens	Paper-based, updating onto computer	*Stangeria eriopus*, Cycad programme, Medicinal plants	Unknown (cycads and palms)	*ca* 4 000	Yes	No	Not applicable	No	Yes Cycads	No	Yes In progress	Not applicable (all landscaped)
South Africa Free State NBG, Bloemfontein	Computerised (using Garden Records Database)	In progress	3	100	No	None	Horticulture Propagation Ecology Conservation Germination Medicinal plants Propagation of indigenous species	No	No	No	On-going	Nama Karoo, Cymbopogon-Themeda vegetation
South Africa Harold Porter NBG, Betty's Bay	In progress. Only the last five years records have been computerised. All new accessions will be computerised.	In progress	25	190 genera, *ca* 508 species	No	Seed incorporated into Kirstenbosch NBG's Index Seminum	Propagation Propagation of indigenous species	No	No	No	In progress. Using Garden Records Database.	Coastal fynbos, local coastal dune vegetation, mountain fynbos and Afromontane forest
South Africa Karoo Desert NBG, Worcester	*ca* 9 000 records so far computerised	Collection of certain Red Data species, *ca* 350 in total	350	4 200	Yes	Yes. Available on request	Horticulture Taxonomy Breeding Propagation Conservation Germination Medicinal plants Propagation of indigenous species	No	No	No	Yes	Worcester/ Robertson area flora
South Africa Kirstenbosch NBG, Cape Town	Computer	Being developed	156	5 000	No	No; Annual Seed Catalogue produced	Horticulture Breeding Propagation Conservation Germination Tissue culture Propagation of indigenous species	No	No, only short term for Orchidaceae and *Encephalartos*	No	Yes, in-house programme using Data Ease to be converted to MS Access	Flora of southern Africa

Botanical Garden	Planting Records	Threatened plants programme	Number of threatened plant species	Number of plant taxa	Seed Bank	Index Seminum	Research	In vitro storage	Pollen Bank	DNA Bank	Computerisation of collections	Floras/ vegetation types represented
South Africa Lowveld NBG, Nelspruit	Paper and computer based. No plant checklist currently available	Population based *ex situ* conservation of *Encephalartos* species in gene banks of between 50 and 100 plants	120	2 054+	No	No	Horticulture Taxonomy Breeding Propagation Ecology Conservation Germination Propagation of indigenous species Reproductive biology	No	No	No	Yes. Current since 1985. Pre-1998 records being manually converted from Data Ease to the Garden Records Database	Rain forest, Afromontane forest, Sand forest, *Androstachys johnsonii* forest, Coastal forest, Mopane bushveld, Soutpansberg Arid Mountain Bushveld, Lebombo Arid Mountain Bushveld, Mixed Lowveld Bushveld, Sour Lowveld Bushveld, central and east African miombo
South Africa Natal NBG, Pietermaritzburg	Computer and paper	Yes	35	*ca* 1 500	No	No	Horticulture Propagation Conservation Germination Propagation of indigenous species	No	No	No	In process	'Ngongoni Veld
South Africa Pretoria NBG, Pretoria	Currently paper-based, in the process of computerising	*Encephalartos* species	Not accurately known	*ca* 5 000	No	No	Horticulture Breeding Propagation Acclimatisation Conservation Medicinal plants Propagation of indigenous species	No	No	No	Not complete	Various

Botanical Garden	Planting Records	Threatened plants programme	Number of threatened plant species	Number of plant taxa	Seed Bank	Index Seminum	Research	In vitro storage	Pollen Bank	DNA Bank	Computerisation of collections	Floras/ vegetation types represented
South Africa Witwatersrand NBG, Roodepoort/ Krugersdorp	Partly computerised, partly paper-based (currently in the process of computerising these records)	Conservation and propagation programmes on various threatened plant taxa in association with various Nature Conservation bodies (e.g. *Aloe peglerae, Melolobium subspicatum, Ledebouria rupestris, Ledebouria galpinii*)	163	370 genera, *ca* 2 000 species	No	No	Horticulture Taxonomy (limited) Breeding (limited) Propagation Acclimatisation Ecology (limited) Conservation (limited) Germination Plant pathology (limited) Ethnobotany (limited) Medicinal plants (limited) Propagation of indigenous species	No	No	No	Partly computerised - plant records in the process of being captured onto Garden Records Database	FSA region, concentrating on plants from the summer rainfall region. Rocky Highveld Grassland; characterised by wooded grassland slopes, rocky ridges and highveld riverine forest along the drainage line
Zambia Munda Wanga Trust Botanical Garden, Chilanga	None	None	One, *Encephalartos trispinosus*	*ca* 1 000	No	No	None	No	No	No	Planned	Not applicable
Zimbabwe National Botanic Garden, Harare	Card system, but information from *ca* 1 500 cards has been transferred onto computer	Garden is used as a refuge for threatened plants	Yes, but actual number unknown	*ca* 2 000	Yes (seed store)	Yes (*ca* 302 taxa)	Horticulture Propagation Conservation Germination Propagation of indigenous species	No	No	No	Currently using a programme written in Dbase IV	Miombo woodland; forest (low-, medium- and high-altitude); semi-arid regions (Zambezi- and Limpopo areas) of southern Africa

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